Student evaluation of career readiness after completing the science education course at Nazarene Teachers College, Kingdom of Swaziland

by

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submitted in accordance with the requirements

for the degree of

MASTER OF EDUCATION - WITH SPECIALISATION IN NATURAL SCIENCE EDUCATION

at the

UNIVERSITY OF SOUTH AFRICA

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FEBRUARY 2017

ABSTRACT

This exploratory study sought to determine how the current science education curriculum at Nazarene Teachers College contributes to the final (third) year's students' career readiness from their own perspectives.

A self-administered questionnaire was used for data collection. The target population was 150 third year students; 110 responded to the questionnaire which had a response rate of 79%.

To describe the biographical information of the respondents, frequencies and percentages were used. Tables of frequency distribution were then used to deduce the respondents' responses to the group of questionnaire questions that probe the various career readiness concepts. Scale reliability testing was also used to determine the reliability of career readiness concepts. An overall measure of career readiness was calculated for each respondent and the effect of biographical properties as part of evaluation of respondents.

The empirical (quantitative survey)showed that the science education course at the Nazarene Teachers College indeed prepares the students for their career readiness with specific reference to the teaching profession although some aspects can be improved. Therefore, it was recommended that there should be increased time allocated to science education and its teaching approaches; that a suitable science laboratory with all the required equipment for experiential learning should be constructed; the current curriculum content with regards to the relevance for primary school science should be reviewed; and the lecturers should be workshopped on the use of interactive methods of teaching science to facilitate active engagement with students. This study reveals that the science education course at the Nazarene Teachers College strengthened the students' attitudes towards teaching science; improved their skills and confidence to teach science and enabled them to focus on a learner-centred approach.

Students indicated that the use of specific teaching methods and the use of teaching aids contributed in a significant way to their preparation as teachers in the classroom. However, the students rated the contribution science makes to society as of minor importance

DECLARATION

I, Eugene Sabelo Mhlanga, declare that this dissertation is my own work except as indicated in the references and acknowledgements. It is submitted in fulfilment of the requirements for the degree of ***MAGISTER EDUCATIONIS*** at the University of South Africa, Pretoria. It has not been submitted before for any degree or examination in this or any other university.

EUGENE SABELO MHLANGA 

Signed at Manzini Kingdom of Swaziland on the 28th day of February 2017.

DEDICATION

This dissertation is dedicated to the researcher's family for their untiring support they have provided throughout the period of the study as well as the researcher's colleagues for their words of encouragement during this "research journey".

ACKNOWLEDGEMENTS

I wish to express my heartfelt gratitude to the following individuals for their contribution towards the completion of this study:

- Mr Mark van Heerden, my supervisor for his outstanding guidance, advice and support. His patience and commitment from the very beginning has been so inspirational to me when everything seemed to be without direction;
- Prof Johann Dreyer for being an insightful co-supervisor;
- Mr Jack Chokwe for his superb English language editing of this dissertation;
- Dr Hélène Müller, the Research Support Consultant (statistics) of the School of Interdisciplinary Research and Graduate Studies in the College of Graduate Studies at Unisa for supporting me with the analysing of the empirical data;
- The administration and the entire Nazarene Teachers' College for their time in assisting me with the data collection, as well as their support throughout my academic study journey; and
- Unisa for all the support and opportunities afforded to me, which included a research bursary and training workshops with specific reference to research.

KEY WORDS

Curriculum evaluation, student's evaluation, students' perceptions, career readiness, course effectiveness, primary school science education course, science education programme, Teachers College students.

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CHAPTER 1: INTRODUCTORY ORIENTATION AND STATEMENT OF THE PROBLEM

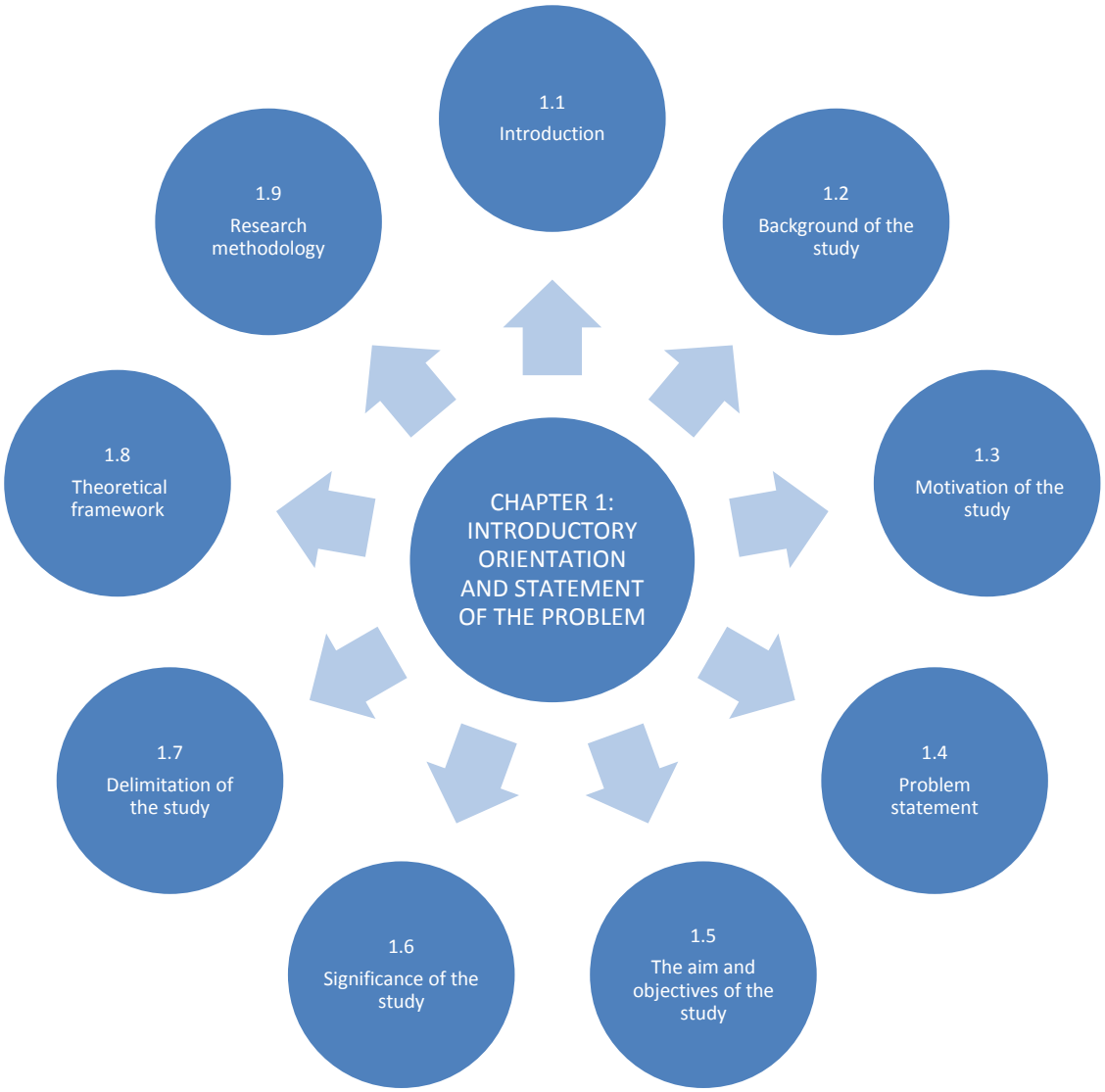

Figure 1: Visual presentation: structure of chapter 1

1.1 INTRODUCTION

This study analysed and assessed how a science education programme at the Nazarene Teachers College(as depicted in Figure 2)in the Kingdom of Swaziland prepares students for their future teaching career. In this chapter, the background of the study is presented, as well as the researcher's motivation to carry out this particular study. The research problem is identified, the main aim of the study is articulated, and the specific objectives indicated. Finally, the significance of the study is stated, and the research methodology is explained.

Figure 2: Photo of Nazarene Teachers College

1.2 BACKGROUND OF THE STUDY

The Kingdom of Swaziland's Ministry of Education and Training Development Plan (2010:20) stipulates that science teaching in Swaziland be regarded as an urgent priority as it has been identified as one of the key professions with great potential for economic growth. The Nazarene Teachers College in Swaziland is expected to assist in the training and development of skilled qualified teachers able to cope with the current challenges and to meet the changing needs of learners in science education (Ministry of Education and Training National Education and Reform Commission Report, 2010:23).

The growing demand for science education teachers and the shortage of skilled specialised teachers specifically in Swaziland clearly indicate a growing demand for teacher education programmes to adequately prepare the students to meet the present and future demands in the teaching industry (Richie, 2009:109). The researcher argues that student teachers who are in training are able to evaluate their own level of career readiness for a career in science teaching as they are the ones who are going through the process of learning. Evaluation of teacher education involves both the perspectives of the students and that of the academic staff as both are integral to the process of producing suitably trained teachers. In this study, the researcher will only focus on the evaluation of the students of the science education course using a rating scale.

Evaluation is arguably the least understood and most neglected element of curriculum design and development of all aspects of teaching (Neary, 2008:166). Neary further points out that teachers and lecturers take much of their time working on the aims of the programme, learning objectives, learning outcomes, competencies to be achieved, teaching, learning and assessment strategies, but do not evaluate the effectiveness of the curriculum(ibid). The researcher, therefore, argues that critical evaluation of at least one science education course is a necessary requirement if science education in Swaziland is to rise to the challenge stated by the Kingdom of Swaziland's Ministry of Education.

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Science education entails the learning of science content and the teaching methodologies used in science teaching (Gobstein, 2010:65). The main emphasis is on teaching science process skills and competencies that lay a strong foundation towards developing a science knowledge base and understanding by learners (Femichel & Schweingruber, 2010:55). Furthermore, students must also acquire science process skills. The six basic science process skills are observation, communication, classification, measurement, inference, and prediction.

The 'move' to include science, technology, society and environment education in science education is increasing and is being applied more broadly in the late 20th century (Johnson& Christensen, 2011:256). Hardem (2009:98) posits that effective teacher education programs cannot be developed if science preparation focuses on content mastery and the education component focuses on process, as the research and reflective components are equally important (Hardem, 2009:99).

The Ministry of Education and Training in Swaziland is dedicated to a thematic, skills-based and pragmatic science programmes for schools. The main emphasis is on teaching science process skills and competencies that lay a strong foundation for developing a solid science knowledge base and learners' understanding while instilling relevant values and attitudes at all levels of the primary school (Ministry of Education and Training National Science Panel Primary Science Syllabus, 2012:2). The central objective and commitment of the Ministry of Education and Training is to provide a broad programme of science well suited to all learners with varied abilities and aptitudes throughout their primary school education (Ministry of Education and Training National Science Panel Primary Science Syllabus, 2012:2).

The national Educational Sector Policy 2010 has guided the development of this science syllabus for the primary science level and the science education based on the 1997 guidelines for Grade One (1) to Grade twelve (12) sciences as well as several guidelines on emerging issues in the field (Ministry of Education National Science Panel Primary Science Syllabus, 2012:2).

When the science programme had been introduced in primary schools of Swaziland, qualified teachers were required to teach the subject (Ministry of Education and Training Development

Plan, 2010: 6). Therefore, there is a need for local teacher training colleges, such as the Nazarene Teachers College, to offer a primary teachers' certificate for students aspiring to become science teachers.

It is therefore clear that the shortage of science education teachers needs urgent attention.

The respondents in this specific study reflected critically on their student experiences, specifically focusing on their career readiness as future science teachers. This will provide empirical data that the academic staff at the Nazarene Teachers College can modify and improve their science education courses to meet the aims of the Ministry of Education in Swaziland, and thereby improve career readiness.

The training of the current and future teachers within the teaching fraternity in Swaziland falls under the mandate of the Teaching Service Commission (Ministry of Education and Training Development Plan, 2010: 2). This means that, in addition to the subject matter, there are specific skills students require to be 'career ready' and these skills should be developed as part of their training and must be evident when graduated students are practicing as teachers. The premise is that academics at tertiary institutions will provide students with education that prepares them for future challenges and opportunities in the teaching career with specific reference to science education at the Nazarene Teachers College. The objective of the study was to investigate if this is indeed the case.

This research, therefore, focuses on the third final (year) students' evaluation of their career readiness after completing the science education programme at the Nazarene Teachers College in the Kingdom of Swaziland.

1.3 MOTIVATION OF THE STUDY

As a lecturer for fifteen (15) years at Nazarene Teachers College, the researcher developed an interest in students' career readiness with specific reference to the final year science education students while lecturing the science education course. The researcher has over the years

observed during teaching practice, for example, that the students encounter some problems in applying the skills and knowledge they have been taught at this specific college in a classroom setting. During teaching practice, student teachers find themselves in different surroundings confronted with unfamiliar learners, members of staff, guidelines, unfamiliar curriculum and novel classroom practices (Whitaker, 2010: 2). The researcher also took note of the findings from the Ministry of Education and Training Report (2011: 4) as well as from the Nazarene Teachers College's Teaching Practice Report (2013: 14) indicating that students experience significant challenges regarding classroom management, curriculum planning and learner discipline during their teaching practice. This has inspired the researcher to find out how "prepared" (career ready) the college students regard themselves for their first year of teaching science education in schools.

1.4 PROBLEM STATEMENT

The researcher has observed the challenges students of Nazarene Teachers College in the Kingdom of Swaziland have to teach science during their first year of teaching at primary school. The current science education programme in the primary schools initiated in the Swaziland education system was meant to promote the appreciation of scientific skills among the pupils and increase interest in science. However, since the science education programme was initiated at the College, there has been no major attempt towards overhauling and redirecting the curriculum to include the socio-economic and career readiness needs of the students. This would have contributed immensely so that when they graduate from the Nazarene Teachers College, there are academically prepared for science teaching and its associated challenges in applying what they have been taught.

The Ministry of Education and Training Report (2011: 44) addresses the lack of teaching skills by organising training courses in order to provide the necessary "top-up" skills. One of the challenging problems facing teacher training institutions is that the areas of learning in their curriculum are not "packaged" in a way that they are occupationally directed. Instead, the student has to study a number of course areas, scattered all over the curriculum in order to be competent for the teaching profession (Taylor, 2009:74).

The science education programme in the college has been a topical issue of discussion among politicians, policy makers and academic practitioners, who feel that this programme needs to refocus on offering content relevant to current issues (Dlamini & Sukati, 2009:58).

According to the Ministry of Education and Training Teaching Service Operational Plan (2011:13) there is a lack of scientific skills in the current qualifications of the teachers and that the development of these scarce skills should be a priority in the teaching profession. Therefore, the researcher realises that the lack of student "input" in terms of preparing them to be prepared for their future careers is problematic. The problem identified is that presently there is no evaluation mechanism to determine if students are career ready to teach science in primary schools.

1.5 THE AIM AND OBJECTIVES OF THE STUDY

1.5.1 Aim of the study

The research aim is to evaluate the career readiness of the final year students after completing the teaching course in science education at Nazarene Teachers College in the Kingdom of Swaziland. The students' evaluation of career readiness would be determined through their reflections on specific aspects of the science education programme.

1.5.2 Objectives of the study

The specific objectives of the study are:

- To gain insight into the evaluation of students regarding their career readiness after completing the science education course at the Nazarene Teachers College in the Kingdom of Swaziland.
- To make recommendations for improving the science education programme based on the evaluation of students at the Nazarene Teachers College in the Kingdom of Swaziland.

These important objectives will align with the main research question, which will be discussed next.

1.5.2.1 Main research question

A research question directs the research design and the collection of data and analysis (Agree, 2009:431). One main research question and some sub-research questions were formulated for the purpose of this research. These questions will keep the study focused.
The following main research question will guide this research:

> How do the final year students evaluate their career readiness after completing the science education course at the Nazarene Teachers College?

This in itself will lead to the following research sub-questions*:

- How do students rate their training in terms of their attitudes towards science teaching?
- How do students rate their training regarding science teaching skills?
- How do students rate their training regarding their ability to teach science processes?
- How do students rate their training in terms of their ability to use appropriate science teaching methods?
- How do students rate their training in terms of their capability to prepare science teaching aids/resources?
- How do students rate their training regarding their competence in facilitating learner-centred pedagogy?
- How do students rate their training regarding their questioning skills and a sound knowledge base in science teaching?
- How do students rate their training regarding their awareness of the nature of science for society?

- How do students rate their training regarding their career readiness according to their biographical information?
- How do students rate their training regarding career readiness taking possible biographical effects into account?

* In chapter 5 the Research Sub-questions have been specifically answered.
The significance of this specific study will now be discussed.

1.6 SIGNIFICANCE OF THE STUDY

The research is significant because it will make available information on career readiness of students after completing the science education teaching course in terms of how it prepared them for their first year teaching in schools. The reflections on the experiences of the respondents could serve as a formative feedback to improve the teaching course at the college. This study will contribute to the existing science education literature, mainly in the areas of curriculum review and development, in relation to the knowledge, skills and competencies required by student teachers. The findings of this study could also assist curriculum developers to revisit the science education curriculum to identify and improve possible dynamics and shortcomings of their curriculum.

The delimitation of the study will now be discussed.

1.7 DELIMITATION OF THE STUDY

This study focuses on the experiences of students regarding the effectiveness of teaching course in science education in preparing them to teach science and was conducted at Nazarene Teachers College in the Kingdom of Swaziland. It was quantitative in nature and a self-administered questionnaire (see Appendix A) for data collection was employed.
The concepts used in this study will now be clarified.

1.7.1 Clarification of the concepts

The following key concepts were used in this study, thus it is important to clarify them here: *science* is the field concerned with communicating science knowledge and processes.

Science education as used in this study refers to the teaching programme used to prepare teachers for teaching science in the primary school. The science education programme teaches students science process skills and competences that serve to lay a strong foundation towards developing a science knowledge base (Vitti& Torres, 2009:68).

Curriculum evaluation is a systematic application of scientific methods to assess the design, implementation, improvement or outcomes of a programme (Rossi & Freeman, 2009:58). Worthen and Sanders (2008:102) define "*curriculum evaluation* as an act of rendering judgements to determine the value-worth and merit of a curriculum". It refers to the processes used to weigh the relative merits and those educational activities which may be deemed to fall within the domain of curriculum practice (Oliver, 2010:29). It may be viewed in a threshold role within the curriculum that is the evaluation that teachers make in the classroom, about the curriculum, that is, appraising the effectiveness of the educational programme in meeting its goals (Oliver, 2010:30).

Students' evaluation refers to the measurement of career readiness by the students after completing the science education course at the College. It is a reflection on the experiences of students on their work readiness, after completing the science education course (Saylor & Alexander, 2008:23).

Teacher training colleges' students need to attain teaching experiences that will make them successful in their teaching careers with specific reference to science education (Coorey, 2013:27). According to Coorey (2013:27), universities and colleges are expected to produce graduates that are work ready. Therefore the researcher argues that, teacher graduates must have mastered the key academic, technical skills and *workplace knowledge* to be effective

teachers. A person who is ‘career ready’ is one that has the ability to connect education and employment.

The above section has clarified the concepts in the context of this study. The scope of the study will now be discussed.

1.7.2 Scope of the study

The research focuses on the students doing their final year at the Nazarene Teachers College in the Kingdom of Swaziland. The researcher selected these respondents because of their authentic experience and knowledge of the science education course at the College.

The study is limited to determining the effectiveness of the science education course at the Nazarene Teachers College, to determine the extent to which it prepares the final year students academically for their first year of teaching in the primary schools of Swaziland. The respondents were selected because it was anticipated that they would be able to provide the information required. The respondents were in the final part of completing the above-mentioned course.

The chapter division of this study will now be discussed.

1.7.3 Chapter division of the study

The research dissertation comprises five chapters. The first chapter deals with the overview of the study that includes details of what motivated the researcher to undertake this specific study; what the research problem is and why it is regarded that the research will be important. Appropriate research methodologies for this specific study are also discussed in this chapter.
In Chapter 2, the researcher concentrates on a literature study as well as the theoretical background of the study with reference to the reflective theory. In this chapter, science education and its importance, curriculum evaluation and its importance, skills that student teachers require, evaluation of science programmes, and the science education curriculum are explained.

In Chapter 3, the research methods used in this research are discussed such as the research design, research methods, data collection, and data analysis.

Chapter 4 focuses on a description and interpretation of students' evaluations that could optimally provide valuable feedback to curriculum designers in order to improve the science education curriculum and ensure an effective programme for the students at the college.

In Chapter 5, emerging analysis and the major findings of this quantitative investigation are presented and recommendations are made.

1.8 THEORETICAL FRAMEWORK

The researcher adopted *reflective theory* for this specific study because the respondents of this study reflected back on their learning and teaching experiences regarding their career readiness with specific reference to science education. According to Helyer (2015:15), reflection can provide a structure in which to make sense of learning so that concepts and theories become embedded in practice. If used effectively, reflection facilitates personal and professional learning and develops practitioners capable of demonstrating their progression towards learning outcomes and required standards (Helyer, 2015:16).The researcher argues that pre-service teachers compare and reflect on their classroom experiences during teaching practice with what they do at the college. That is why the questionnaire used in the study was based on reflections of students. Bolton (2010:150) argues that reflective practice makes sense of events, situations and actions that occur in one's teaching.

According to the researcher, the use of this theoretical framework is important as pre-service teachers often enter teacher education programmes with problematic or unexamined assumptions, beliefs and knowledge about students' teaching and role of schools in society (Carrington & Saggers, 2008:195). This theoretical framework helps the pre-service teachers to compare their learning experiences in the College with what they experience during their teaching practice in the primary schools. As mentioned above the final year students reflect on their past learning experiences.

The researcher opines that in the pre-service teacher science education programme students should be motivated to reflect on their subjects and teaching knowledge and embrace what can be done to develop their academic performance as teachers. Reflection may elicit a range of emotions ranging from doubt as well as elation regarding the very important notion of the preparation of pre-service teachers with hands-on experiences that they can apply when they are professional teachers at schools. Reflective practice also contributes to learning and expressing our own and others' stories (Ivan, 2012:53).

According to Loughran (2012:33), reflection and learning from experience is key to staying accountable, maintaining, and developing aptitude throughout your practice. Loughran (2012:33) further contends that reflection is a vital process of learning from experience that allows you to evolve as a practitioner through learning from past experiences. This resonates with the researcher's view that reflection of teaching practice is an important part of career readiness of the final year pre-service science education students. The researcher further argues that reflection could be a helpful tool in the students' evaluation of their science education course at the College.

The researcher will now provide the research methodology that will be used for this specific study.

1.9 RESEARCH METHODOLOGY

In this section, the researcher addresses the following topics: research approach and design, population, data collection method, validity, data analysis, interpretation, and ethical considerations.

1.9.1 RESEARCH APPROACH AND DESIGN

The three research approaches in educational research are qualitative, quantitative and mixed (Creswell, 2012:73).

As mentioned above, a quantitative research approach was followed in this study with the purpose to describe the students' evaluations of their career readiness after completing the science education course at the Nazarene Teachers College. The quantitative approach was used because the primary data on students' evaluations were obtained using a questionnaire. Quantitative research relies primarily on the collection of quantitative data (Johnson & Christensen, 2011:33).According to Creswell (2010:73) quantitative data is based on precise measurements using structured and validated data-collection instruments. In addition, a quantitative research study has objective data that is gathered and analysed numerically (McMillan & Schumacher, 2012:107).

The research design of this study will now be described.

1.9.2 Research design

An *exploratory research design* in a form of a case study was employed in this study to investigate students' evaluations of their career readiness as based on their reflections of the past after completing the science education curriculum. Exploratory research provides a better understanding of a situation (Brains, Willnat, Manhein & Rich, 2011:76). It is conducted for a problem that has not been clearly defined and often occurs before we know enough to make conceptual distinctions or posit an exploratory relationship (Brains, et al., 2011:76).

Considering the nature of the research problem to be studied, a survey was used to gather data. According to Sincero (2012:94), surveys allow a high representativeness, low costs for the production of questionnaires, convenient data gathering, good statistical significance and precise results as it should undergo careful scrutiny and standardisation.

1.9.3 Research methods

1.9.3.1 Data collection method

Merriam (2009:85) states that data comprises ordinary pieces of information found in a specific environment, such as the one that exists at the Nazarene Teachers College in Swaziland.

According to Johnson and Christensen (2011:35), data collection methods refer to the techniques for physically obtaining data to be analysed in a research study. This study employed a questionnaire to collect data (see appendix A).

A self-administered questionnaire, as mentioned above, was chosen for data collection and was disseminated by hand. The advantageous use of questionnaires by the researcher is that respondents are able to read the questionnaire and record their response without the presence of a trained interviewer. Additionally, these questionnaires cut down telephone costs, reduce the researcher travel costs and also offer respondents anonymity (Leedy & Ormrod, 2010:185).Since the respondents have completed the questionnaire without the influence of a trained interviewer, the chance of giving answers that “fit” the researcher’s pre-conceived ideas are greatly reduced.

At the beginning of data collection, the researcher distributed consent letters to the respondents seeking their consent to participate in the research and to sign for the anonymous use of information gathered in the research. Ultimately students were subsequently given the questionnaires to record their responses.

1.9.4 Population

The target population was the final (third) year students who had just completed the science education course because these respondents were in an ‘ideal’ position to share their own opinions by reflecting on the entire science education curriculum of the above-mentioned College. The respondents evaluated the science education course in terms of career readiness.

1.9.5 Data analysis

Aaker and Kumar(2011:42) describes data analysis as “the process of reducing accumulated data collected in research to a manageable size, developing summaries, looking for patterns performing statistical analysis”. This study followed a quantitative data analysis, which is usually in the form of numbers that are analysed using various statistical procedures. The process of analysis involves getting to know the data and this depends on understanding it through reading and re-reading. Descriptive and inferential statistics were used to summarize and interpret the quantitative data. The Statistical Package for Social Sciences (SPSS) was used for this purpose. Frequencies and percentages were calculated, overall mean values and standard deviation, scale reliability tests, Cochran Armitage trend test and analysis of variance.

1.9.6 Issues of reliability

According to Struwig and Stead (2013:90), “a small group of people who are representative of the group that is being targeted are used for the reliability “test” that is required for this study. Reliability is critical for identifying questionnaire problems”. Problems with question content include confusion with the overall meaning of the question and misinterpretation of individual terms or concepts (ibid).

Testing for reliability identifies and eliminates significant differences in the way the respondents unpack the questionnaire items. Unclear questions that have the potential of bringing confusion are also identified.

The questionnaire was piloted with respondents who were final year students at Nazarene Teachers College that were not involved in the study. The students answered the questions well and could understand the items in the questionnaire. There was no question they did not understand.

1.9.7 Ethics considerations

Since the research was conducted in an educational setting, it was necessary first to seek permission from the Director of Education in Swaziland; the Principal of the Nazarene Teachers College (see Appendix C) and from the respondents (see Appendix B). The Ethical Clearance Committee (see Appendix E) granted the ethical clearance certificate from the College of Education at Unisa. The Principal's submission to the College of Education's (CEDU) permission letter to conduct research was obtained (see Appendix D).

The researcher distributed letters of consent (see Appendix F) to the respondents requesting their written consent for their participation and care was taken to explain the content of the letters to the students in a language that they understood. The researcher also spent some time with the respondents prior to conducting the survey to explain the process to them in an effort to create mutual understanding and ensure them anonymity of their identities on the information they recorded.

The researcher assured the respondents that their identities would be concealed so as to ensure anonymity, confidentiality and privacy.

The researcher regarded it as his responsibility to inform the respondents of all the possible consequences of participating in the research. Accurate information was given to the respondents for them to make voluntary and informed decisions on their interest to participate in the research. The main aim of this specific study was communicated to the respondents.

1.9.8 Summary

This chapter has highlighted the background to the study. The research problem was presented. This chapter specifies what exactly motivated the researcher to conduct this study. In this chapter, the researcher also provided the main research question, sub-research questions, the aim, and objectives of the study. The quantitative approach was used as the research approach. Data analysis and ethical considerations were also discussed.

In the next chapter, the focus will be on the literature review related to this study.

CHAPTER 2: LITERATURE REVIEW

Figure 3: Visual presentation: structure of chapter 2

2.1 INTRODUCTION

This chapter presents the literature review with the focus on the final year students' evaluation of their career readiness after completing the science education course at the Nazarene Teachers College, in the Kingdom of Swaziland.

This chapter has a brief description of the Kingdom of Swaziland, the Nazarene Teachers College, the science education course, curriculum evaluation and evaluation of career readiness. The literature review also provides the theoretical framework for this study with specific reference to the reflective theory.

To put this study and the students' evaluation of career readiness after completing the science education course into perspective, the researcher will briefly describe the Kingdom of Swaziland, Nazarene Teachers College, the science education course, curriculum evaluation and evaluation of career readiness. The researcher also analyses the literature findings to determine the theoretical framework underpinning this study.

2.2 THE DEMOGRAPHY OF THE KINGDOM OF SWAZILAND

According to the Southern Africa Development Countries, (2013: 40):

> *"…The Kingdom of Swaziland is small landlocked country which covers just over 17000 square kilometres. It is situated between the Republic of South Africa and Mozambique, and is often referred to as the 'Switzerland of Africa.' Swaziland comprises magnificent mountain scenery with unique ancient rock formations, which are a fascination for geologists, scholars and visitors."*

Education is considered an important "tool" for economic and social development in Swaziland. The government of Swaziland aims at making education less expensive and available to all. The schools in Swaziland are also classified into three types, namely; governmental, grant-

aided and private. Education begins at primary school and progresses through high school to the tertiary institutions consisting of colleges and universities. Primary education is funded by government and offered free for all learners (Southern Africa Development Countries, 2013: 40):

The United Nations Educational Scientific and Cultural Organization (UNESCO) Institute for Statistics, (2006: 24) reported as follows:

> *"In line with the Millennium Development Goals (MDGs) and the Constitution of the country, the government has phased in free primary school. Primary school level lasts for seven years while the secondary level is for three years. The last two years of high school are for the International General Certificate Secondary Education (IGCSE)."*

There are three (3) Teacher Training Colleges in Swaziland namely: Ngwane Teacher Training College, William Pitcher Teacher Training College and Nazarene Teacher Training College.

Education and quality training with specific *reference* to teaching is regarded as very important as it is linked with the (MDGs).

In the next section, the Nazarene Teachers College will be briefly described.

2.2.1 Nazarene Teachers College

The Nazarene Teachers College is a government grant-aided institution run and controlled by the Church of the Nazarene (see Figure 4).

Figure 4: Photo of Nazarene Teachers College

The Nazarene Teachers College is located on the main campus of the mission of the Church in Manzini (Swaziland) and can be reached easily through the main mission entrance gate and about a quarter of a kilometre past the Raleigh Fitkin Memorial Hospital westwards.

The Nazarene Teachers College (NTC) prospectus (2013: 1-10) indicates that the College orients its teachers' training programme and policies towards students who seek preparation for a full life of service to human kind and to do so in a Christian environment. Furthermore, the College's specific goals are to reflect Christian principles, provide a quality academic programme, and produce Christian teachers with a quality education and a service-oriented attitude.

From the above, the location as well as the ethos of the Nazarene Teachers College has been highlighted. The science education course at the College will now be briefly discussed.

2.3 THE SCIENCE EDUCATION COURSE

The course curriculum content of the primary school science covers three areas, namely; energy and forces, materials, and living organisms which are the basics for Physics, Chemistry and Biology (Murphy, 2008:70). Science at the primary school does not only embrace knowledge, but also the scientific method and its impact on learners. Science education at primary schools aims at:

- developing science process skills.
- obtaining scientific concepts.
- developing positive attitudes (Murphy, 2008:70).

Primary science education centres on the work of teachers and the dilemmas involved in deciding what learning matters for their students and how their professional practice will nature this learning (Lindsay, 2011:16). The inclusion of science education in the primary school curriculum has brought a major change to the curriculum of primary schools and reflects the importance that science and Technology have in many aspects of our daily lives such as at work, school and at home)(Murphy, 2008:70)..

Primary school science teachers must determine how, when and where they attend to a range of explicit science curriculum outcomes while also give themselves time to balance teaching and learning requirements (Smith & Fitzgerald, 2013:16). These decisions are informed by personal and professional experience, including professional understandings of content knowledge, personal thinking and beliefs about the importance of science and ideas about what science matters for their students (Fitzgerald, 2012:164).

According to Murphy (2008:73), the primary science curriculum offers schools a comprehensive programme from infants to the sixth class. The researcher agrees that it provides a very good foundation for the study of science subjects in the post-primary setting. It cultivates a positive attitude towards science as well as providing pupils with opportunities to experience the excitement of working as a scientist.

In terms of this study the primary science course at Nazarene Teachers College aims at demonstrating knowledge that is linked to the body of pupils, their surroundings, explaining the environmental changes that occur around the pupils, engaging in informed interactions between the environment and the learners, acquiring scientific knowledge, science process skills, and competencies.

Heap (2013:89) argues that teachers think about science in different ways, and therefore "work" with science in different ways; they understand the nature of science and find opportunities for science teaching and learning within the context of their classroom. Furthermore, Smith and Fitzgerald (2013:12) state that science teachers in the primary school have much in the way of expertise to contribute to quality science teaching and learning.

Schecker (2009:56) states that the teaching of science can be better explained through conducting research in science education. According to the researcher, the aim of science education research is to clarify the composition of scientific knowledge and how it can be taught. The way science is communicated in schools arouses interest among the students (Hardem, 2009:85).

Kerns (2010:53) points out that "practicals" are indeed of crucial importance in science Education and play a role in:

- Encouraging observation and keeping records;
- Promoting science methodology;
- Creating hands on experiences;
- Deducing what was learned; and
- Developing positive attitudes towards science.

According to the Ministry of Education and Trainings' Primary Teachers' science education Syllabus (2014: 8), the following are some of the programme goals to be achieved by the science education students:

- A positive attitude towards science;
- Techniques in the teaching of science;
- Techniques to use the processes of science;
- A range of skills appropriate for science teaching;
- Confidence in the preparation of science teaching aids and apparatus as shown in Figure 5 depicting the use of plastic water bottles as containers;
- Develop a broad scientific knowledge base; and
- Develop an awareness of the contributions of science to the society.

Figure 5: Photo of preparation of science teaching aids using plastic bottles

To ensure the necessary understanding of the science education course, a literature review on curriculum studies and evaluation will now be discussed.

2.4 CURRICULUM STUDIES AND EVALUATION

Curriculum studies in education include curriculum evaluation which is a process of judging the worth or value of a curriculum. Curriculum studies focuses on curriculum development and teaching.

According to Pinar (2009:25), curriculum theory and practice and how they are connected to the school programmes and society should be considered in curriculum evaluation. Curriculum evaluation means rendering a value judgement to a set of experiences selected for educational

purposes. It is a process that involves gathering information about the effectiveness of curriculum and measurement done in terms of levels of achievement of the pre-set objectives (Naikumi, 2010:56).

Tyler (2009:22) has also pointed out in this regard that evaluation should be an important task of the curriculum development process. This is, according to the researcher, important because it enables one to determine to what extent, if at all, the objectives of a programme have been achieved.

Alkin (2008:26) defines evaluation as “a way of obtaining decisions that should be made, choosing similar data, gathering and analysing data for the purpose of reporting the results”. Two major actions involved in evaluation are termed *description* and *judgement*.

According to Lawton (2010:47), the term *description* involves actions that are concerned with securing, organizing and reporting information. The term *judgement* includes those actions that are concerned with assigning meaning, and determining relationships, identifying importance and reaching conclusions.

It has been suggested by many authors or curriculum specialists that curriculum evaluation refers to the method applied when determining the strengths of the activities applied in curriculum practice. It is a very broad area that encompasses a wide range of diverse properties (Oliver, 2010:29). Evaluation may even be viewed as having a threefold role, namely:

- Within the curriculum, that is the evaluation that teachers make in the classroom;
- About the curriculum, that is, appraising the effectiveness of the educational programme in meeting its goals; and lastly
- Appraising such outcomes as problem solving ability and skill in human relations (Oliver, 2010:30).

For this study, the second role is also of significance.

The terms *curriculum* and *evaluation* were examined. Some of the evaluation models and types of evaluation will now be discussed.

2.4.1 Models and types of evaluation

According to Hakan, Saglan and Vural (2011:62), there is an element–based curriculum evaluation model which considers the opinions and viewpoints of participants regarding all components of the programme to identify whether the curriculum has addressed the prescribed objectives. Furthermore, Silva and Fernandes (2010:102) point out that there is an Importance Performance Analysis (IPA) model of curriculum evaluation, which involves the analysis of attitudes towards the main product or service. It examines not only the performance of an item, but also its importance as a determining factor in satisfaction to the person. It also helps students determine if they are satisfied with the institution's performance (Silva & Fernandes, 2010:102). The IPA model requires the evaluation of context, input, process, and product in judging a programmes value (Silva & Fernandes, 2010:102). This model of evaluation aligns with the approach in this study.

Formative, summative and diagnostic evaluation are the three main types of evaluation (Naikumi, 2010:43). Formative evaluation occurs during the course of the curriculum development and its purpose is to contribute to the improvement of the education programme. In summative evaluation, the final effects of a curriculum are evaluated based on its stated objectives and it takes place after the curriculum has been fully developed and put into operation (Naikumi, 2010:44). In contrast, diagnostic evaluation is directed towards two purposes either for placement of students at the outset of an instructional level or to discover the underlying causes of deviancies in student learning in any field of study (Naikumi, 2010:44). Diagnostic and summative evaluation were used in this study.

The researcher has briefly described some relevant evaluation models and types of evaluation and will now describe the concepts "*evaluation* and *assessment"*.

2.4.2 Evaluation and assessment

According to the researcher, it is important to distinguish between the terms '*evaluation'* and '*assessment'*. The former concept is used to determine whether the outcomes of a programme have been achieved or not. The latter concept is described by Angelo and Cross (2011:157) who stated that assessment embraces learning, teaching and learning outcomes. Assessment gives knowledge to assist in the teaching and learning process. Assessment reveals to an institution the level of understanding of course content by the students.

As mentioned previously the study evaluated if students consider themselves to be career ready after completing the science education programme at the Nazarene Teachers College.
The concept of needs assessment will now be clarified.

2.4.2.1 Needs assessment

According to Altschuld and Kumar (2010:29), *needs assessment* is "a systematic process for determining needs or gaps between current conditions and envisaged conditions". It is a method of discovering and looking at the requirements between prevailing conditions and what they could ideally be. Lack of compatibility in the present state and required state should correctly determine the need to be addressed. Needs assessment is part of the planning process often used for improvement in individuals, education/training, organisations, or communities (Altschuld & Kumar, 2010:29).The current research could assist in upgrading the students' education and training that will ultimately benefit the Nazarene Teachers College.
Briggs and Ackerman (2009:132) have pointed out that:

> "…*needs assessment formally identifies the gaps between current results, outcomes, or products and required, desired or expected results. It prioritises these identified gaps for action usually through the implementation of a new or existing curriculum and management process."*

Needs assessment can also help improve the quality of the policy or programme decisions, thus leading to improvements in performance and the accomplishment of desired results. The results of needs assessment will guide subsequent decisions, including the design, implementation and evaluation of projects and programmes that will lead to achieving desired results (Watkins & Yisser, 2012:5).

The researcher concurs with Altschuld and Kumar (2010:29) as well as Briggs and Ackerman (2009:132) that needs assessment is a useful 'tool' in programme evaluation and this is suitably applied in the study at the Nazarene Teachers College (see Appendix A).

2.4.3 Functions and roles of curriculum evaluation

Evaluation determines the quality of a programme, course or even classroom teaching as it is measured against the objectives set out at the start of the process. The concept *evaluation* is used to describe the determination of the level of quality by focusing only on the actual level of quality of performance (Mahmnae, 2010:67).

According to Carl (2010:98) the functions of curriculum evaluation are as follows:

- To determine the success of instruction;
- To determine the suitability of an curriculum;
- To monitor progress and identity defects timeously and correct them;
- To determine whether grading and advancement are possible;
- To compare the actual outcomes with expected outcomes and arrive at conclusions about the comparisons with a view to future action; and
- To direct re-planning and adjustments.

The researcher as a lecturer could assist with improvements in teacher preparation at Nazarene Teachers College.

According to Kelly (2009:52), the principal purpose of evaluation is to contribute to decision making. It is hoped that the results of the current study will contribute information that can be used in decision making at the Nazarene Teachers College and even at the other colleges in Swaziland.

In the following section, the evaluation of career readiness after completing the science education course will now be discussed.

2.5 Evaluation of career readiness

Since this research aims to investigate students' evaluation of their career readiness after completing the science education course at Nazarene Teachers College, the final year students' experiences would be described through their own reflection regarding specific aspects of the science education course. The researcher notes the importance of ascertaining the aspects of the science education course that will make the teaching students career ready.
During the teaching and learning process, there are many important competencies and skills that are regarded as essential.

The following question arises: What kind of knowledge should science teachers possess to be effective in the classroom? This question is answered by Magnusson and Loughran (2010:45) who state that science teacher training should include the following:

- *Characteristics of science* education as being based on observation and experiment. This is what distinguishes science from other paths to knowledge;
- *Teaching situations* and their locus of control with the effects on students' learning;
- *Management of the teaching situations*;
- *Scientific communication* such as the presentation of science lessons, using the appropriate skills to produce one or more personal responses to science or change learners' attitude to science; and

- *Evaluation.* This provides opportunities to test the achievement of the science lesson objectives. Strengths and weaknesses of a programme can be deduced through this process.

Magnusson and Loughran (2010:46) identified the following characteristics which describe a well-prepared science teacher, namely:

- Competent in scientific knowledge, including scientific theories;
- Competent in making use of relevant reference material. (Literature read and cited should have current or up-to date scientific information);
- Competent in science education. He or she should possess a broad knowledge of Science instruction and also be able to choose the proper methodologies when teaching;
- Competent to apply the appropriate theories of teaching Science and be creative in teaching science topics;
- Competent in the selection of subject matter; and
- Competent in evaluation. He or she should provide opportunities to test for the achievement of objectives in a correct manner or be able to evaluate students in an effective way.

Mazibuko (2011:37) indicated that effective science teachers should:

- Increase learning on the part of learners;
- Bring about the desired pupils' learning by educational activity;
- Bring the desired outcomes in learners;
- Predict the success of any educational programme that has been implemented;
- Reinforce behaviour by their students; and
- Determine appropriate objectives and doing the right things in the context of a school setting.

Osborn and Millar (2011:128) indicated that there are various “pitfalls” linked with the teaching of Science. To deal with these issues, teachers should:

- Have sound science knowledge and thoughts;
- Present the curriculum in a coherent way. In a logical connected, clearly articulated or consistent manner;
- Should instil the desire to learn about science principles;
- Have knowledge of pupils’ scientific capabilities. Know how capable your learners are scientifically; and
- Be selective on the various important activities for assessment.

Some of the competency-based teaching approaches that the students should acquire include: investigatory projects; problem solving; simulation; role playing; observation; group discussion; seminar; questioning; written assignments; specimens; demonstration; instructional real objects; case study; field trips and attending exhibitions and science fairs.
In the next section the theoretical framework of this study will be discussed.

2.6 Theoretical framework

This research study is anchored in *reflective theory*. According to the researcher, a practitioner must be able to practice self-reflection by looking at an individual’s past experiences and then giving feedback regarding the “strengths and weaknesses” of these experiences which in turn can be beneficial to the individual and their institution.

The reflective theoretical framework enhances the ability of pre-service teachers to reflect on their experiences as far as the context of the teacher preparation programme is concerned. The reflective practice allows students to be more observant and analytical on their past learning experiences and so this enables them to evaluate their programmes in the training institutions, thus, making their contributions valid.

According to Pedro (2011:67):

> "*This theoretical framework applies a symbolic interaction theoretical and analytical framework to give voice to the pre-service teachers within the historical and institutional contexts of a teacher preparation programme.*"

Reflective practice has become a useful theory in science teacher education research and programmes. This is borne out by Pedro (2011:145) who states:

> "…*critical reflection raises teachers' awareness about teaching, enables deeper understanding of variables related to teaching, and triggers positive changes in their practice.*"

The researcher is of the opinion that critical thinking and reflection by students can help promote the theory and practice required in teaching, as it allows for their assessment of the science education course and in so doing enhance their personal and professional development.

This is further substantiated by Jasper's (2013:57) opinion as follows:

> "*In addition to taught theoretical components and completion of a professional development portfolio, a guided approach incorporating multi-sourced feedback and reflective assignments has been implemented to facilitate professional development and the development of reflective skills.*"

Furthermore, the researcher agrees with Pedro (2011:145) and Jasper (2013:57), namely that reflective practices are ways and strategies that can enhance students' ability to place more focus on their learning experiences.

Reflective practice can be an effective method for students to contemplate the curriculum and in this study the science education curriculum at Nazarene Teachers College. This can, for example, serve to develop a reflexive stance by students to further enhance their career readiness as teachers. This is supported by Duffy (2009:105) who states that:

> "…*the reflective practice is deemed an essential skill for future practitioners to learn and perform and provides the framework for transferring and applying learning (theory) into different practical scenarios.*"

Nolan (2008:31) indicates that the expertise required in reflection is taught and is essential in teacher education.

According to the researcher, reflective practice is also necessary in combining theory and practice and labelling different schools of thought. This is explained by Mann (2009:131) who states the following:

> *"…what is important about reflection throughout your practice is that you are not just looking back on past actions and events, but rather you are taking a conscious look at the emotions, experiences, actions, and responses, and using that to add to your existing knowledge base to draw out new knowledge, meaning and have a higher level of understanding.*"

The researcher agrees that reflection is a useful tool to encourage the upgrading and progression of qualified teaching professionals.

A summary of the discussion from this chapter is elaborated in the following paragraph.

2.7 SUMMARY

In this chapter, the researcher has illuminated the issues of science education, curriculum evaluation, evaluation of career readiness after completing and the theoretical framework relevant for this study. It can be summarised that curriculum evaluation enables the reader to determine the effectiveness of the curriculum, students' learning and students' career readiness. Needs assessment and its importance in teacher education have been highlighted and discussed.

The researcher further argues that science teaching indeed guides and supports students with the capability to identify knowledge and the information needed to understand scientific concepts. Furthermore, science describes, for example, the way human body and modern transportation methods work. According to the researcher, science teachers have a “mandate” to make this knowledge contribute towards understanding new scientific concepts that are of crucial importance for the millennium age.

Chapter 3 will now focus on the research design and methodology.

CHAPTER 3
RESEARCH DESIGN AND METHODOLOGY

Figure 6: Visual presentation: structure of chapter 3

3.1 INTRODUCTION

In the previous chapter, the literature on curriculum evaluation has been reviewed with the focus on the science education course. Skills and competencies that the teachers require for their career were also identified (in chapter 2).

This chapter includes discussion on the research approach, research design, population and sampling, data collection techniques, questionnaire design, and the analysis of data.

The research approach of the study will now be discussed.

3.2 THE RESEARCH APPROACH

Quantitative research depends primarily on gathering data, which is observable, measurable and quantitative. It involves the numerical analysis of data gathered by different means such as questionnaires. This type of research relies on the collection of quantitative data (Johnson & Christensen, 2011:20). The data are gathered and analysed numerally (McMillan & Schumacher, 2012:12).Most people conducting quantitative research identifies cause and effect relationships that allow them to determine probabilities and make generalizations (Leedy & Ormrod, 2010:98). Quantitative research answers questions on relationship that exist among measured variables and in the end process data by describing, guessing and controlling (Leedy & Ormrod, 2010:98).In this study, research questions were used to gather data.

According to Creswell (2010:131), quantitative data requires correct measurements using information that has been structured in appropriate data – collection instruments. Quantitative research uses what might be called a “narrow-angle lens” because it considers one or a few causal factors at once. Quantitative researchers always make sure they hold the factors that are not being studied constant (Alexander & Hudson, 2010:63).This specific survey quantitative research is undertaken from a positivist paradigm.

After having discussed the research approach to be used in this study, the researcher will now discuss the research design.

3.3 THE RESEARCH DESIGN

Jeniffer (2010:78) defines research design as a strategic way of studying scientific problems. A research design is a road map of conducting research. In addition, Gorard (2013:40) defines it as a framework for carrying out a marketing research project. To be effective, a research design should have the following:

- A list of objectives of the study;
- The data inputs required on the basis of which the research problem is to be solved; and
- The methodology to use when treating and analysing the data.

A research design examines at the results and encompasses the following:

- The type of study to be done;
- The type of results sought;
- Research problem/question; and
- The type of evidence necessary for explaining the research question (Stake, 2013:5).

The research design forms a key element of the empirical study and contributes to the total success of the study. According to Stake (2013:5), a research design may be grouped into categories, namely, exploratory, descriptive and causal.

An exploratory research design had been used in this study to investigate students evaluation of the science curriculum presently followed at the Nazarene Teachers College.

Exploratory research, as mentioned, is conducted as a way to have better understanding of a specific situation. It is carried out when there is a particular problem that is not well described and mostly takes place before much is known for making conceptual differences (Brains, et al., 2011:76). The outcomes of an exploratory research cannot be used alone for making decisions

instead can give an important direction into a certain condition. Usually, when carrying out an exploratory research, it should be expected that the following research is needed to give conclusions.

Exploratory research is selected for this specific study for the following reasons:

- When you have a new topic and a problem in data collection;
- When the research approach is not fixed, describing all kinds of research questions;
- The outcomes of the study will be able to give an important look into the provided condition;
- When the study is not useful in making general statements about the population; and
- When the study aims to determine the suggestions and focus of the sample.

Exploratory research is appropriate for this study based on the above-mentioned argument. This localised study is a new problem as it has not been researched before. The “answers” the students provided allowed the researcher to get an important insight into the problem from the perspective of the students.

This section examined the research design for this research. Following this, the data collection method will be explored.

3.4 DATA COLLECTION METHOD

Data collection is important in all types of research. Moreover, it is important to follow the correct method for your study to get good outcomes of the study. This study is quantitative in nature and it will use the quantitative data collection methods. Altshuld and Witkin (2009:155) propose the following quantitative data collection methods:

- Using observations and keeping records of clearly elicited situations;
- Making use of management information systems; and
- Using surveys.

For this study, a survey was selected for collecting data for its suitability to the research topic. Fowler (2009:23) compares online surveys, face-to-face, telephone and mailed and concluded that online surveys are cheaper, speedy and independent of time and space. Their weakness is the dependency on internet access. The advantages of using this survey method are as follows:

- It is easily administered;
- Less time can be spend for its development;
- It is economical;
- Can be applied electronical;
- Data can be collected from a large population;
- It accommodates a lot of questions which results in a flexible data analysis;
- Allows a well distributed data collection; and
- It allows for making generalized inferences about the target population.

In this section, the researcher examines the data collection method for this research and this will lead to data gathering techniques which are discussed next.

3.4.1 Data gathering techniques

William (2009:37) states that there are four (4) major data gathering techniques, namely:

- Personal interviews;
- Telephone interviews;
- Mailed questionnaires; and
- Self-administered questionnaires.

A self-administered questionnaire had been selected for this empirical survey as the most suitable method of collecting data for this study and that the questionnaires will be disseminated by hand. In this method, the respondent reads the questions and records his or her own

responses. The advantage of this technique includes the presence of a person to respond to any questions that may arise. According to Hunn (2009:62), self-administered questionnaires have the following advantages:

- They cost less to distribute to the respondents;
- They are easy to distribute and analyse;
- Many people are used to this method;
- It discards any occurrence of biasness in an interview schedule;
- The respondents are free to answer sensitive questions in good faith; and
- The questionnaires can be completed at convenient times and place.

This section has focused on data gathering techniques. Following this, the questionnaire design will be discussed.

3. 4.2 Questionnaire design

A well-designed questionnaire has been developed to make a survey successful and the researcher should come up with his own good design (Crawford, 2010:208). Furthermore, Crawford (2010:208) states that a good questionnaire design should assist in getting the objectives of the study, provides correct information and is easily filled in by interviewers and the respondents.

According to Trochim (2008:5), using questionnaires have advantages and disadvantages. A questionnaire costs less, ask all respondents similar questions and can ensure anonymity. A disadvantage of using a questionnaire may be lack of adequate time to complete the instrument, which may result in the return of superficial data (Muijs, 2011:38). However, Leedy and Ormrod (2010:186) indicate that questionnaires take more time to answer; hence not returned at the expected time. Leedy and Ormrod (2010:186) also state that respondents may provide unclear answers because of misleading questions.

An expert statistician of the University of South Africa was consulted for the process of the questionnaire design.

In the preceding section, the researcher described the questionnaire design. The questionnaire structure will also briefly be discussed in the next section.

3.4.3 Questionnaire structure

The questionnaire has been developed to include the specific objectives of the study as explained in Chapter one section 1.5. These are as follows:

- To gain insight into the evaluation of students regarding their career readiness after completing the science education course at the Nazarene Teachers College in the Kingdom of Swaziland; and
- To make recommendations for improving the science education programme based on the evaluations of students at Nazarene Teachers College in the Kingdom of Swaziland.

The questionnaire is initiated with an introduction and invitational greeting, introducing the respondent to the study and also giving the respondent an assurance of anonymity. Instructions to be followed when attempting to answer the items of the questionnaire have been given to elicit responses from the respondents. The questionnaire comprises of three (3) sections. The first part of the questionnaire identifies the biographical information of the students. This includes gender, age, teaching experience and studying of science at high school or matric level.

The second section of the questionnaire focuses on evaluating the effectiveness of the science teaching empowerment objectives of the science education curriculum of the Nazarene Teachers College. This section aims to determine the respondents' experiences of how they are ready for teaching as a result of the achievement of the objectives in the curriculum. The respondents evaluated the effectiveness of these objectives in a five point Likert scale from 1: "*Not at all*" to 5: "*Always effective*."

The third section consists of open-ended questions on comments and suggestions regarding the curriculum and the training provided at the Nazarene Teachers College. The students were to add anything about the curriculum and training provided at the College.

The pre-testing of the research instrument will now be discussed.

3.4.4 Pre-testing

After the researcher has drafted and developed the questionnaire, it was sent to the supervisors and statistician for critical review. This was an iterative process as the instrument was critically engaged with and it required 10 cycles of revision. It still had to be tested as the pre-testing of a questionnaire is crucial to a good survey. According to Struwig and Stead (2013:291), a small group of people having similar characteristics as those targeted are involved in pre-testing. Pre-testing is essential when you want to find out the problems of a questionnaire and these problems include a loss of meaning of the question (Schumacher, 2012:192). A self-administered questionnaire needs to be well formatted so that very important information is not lost. Hence, the critical cycle of reflection and critical, though bearing the research question in mind was integral to the researcher development of the data collection instrument.

The aim of pre-testing is to see and hence discard differences in the respondents' understanding of the questionnaire. Schumacher (2012:192) indicates that it is done to determine the level of understanding the items of the questionnaire by respondents and to identify the items of the questionnaire that are unclear. Pre-testing also assists in ascertaining how much time was spent by respondents when completing the questionnaire, thus solving any problems arising in this regard.

The researcher piloted the questionnaires with a small number of respondents of the Nazarene Teachers College that will not be participating in the main part of the study. Five (5) respondents participated in this pre-testing instrument. The five (5) respondents were requested to not only answer the questions but to also indicate which questions were ambiguous or not well formulated. There was space after each section of the questionnaire for the respondents to write

their personal comments. Feedback and analysis of the five (5) questionnaires resulted in the rephrasing of certain items of the questionnaire.

In the preceding section, the researcher discussed how the pre-testing component of the development of the data collecting instrument was carried out. In the following section, sample selection will be discussed.

3.5 SAMPLE SELECTION

This is the process of selecting a number of individuals from a population, preferably in such a way that the selected individuals represent the larger group from which they were selected.

According to Johnson and Christensen (2011:220), sampling is carried out by identifying a small group to represent a population. The sample can be individuals, groups or objects representing a larger population following some rules. Bradley (2008:172) defines sampling as “a systematic way of choosing proportions from a population for the reason of scrutinizing and generalizing to the whole population”. This means taking less time and paying less than looking at the whole population. Garson (2012:10) states that sampling entails selecting the subjects of the study. A sampling method is the scientific procedure of selecting a sample. Groves (2010:348) has elicited the following ways of taking a sample:

- Simple random sampling;
- Systematic sampling;
- Stratified random sampling;
- Cluster sampling; and
- Quota sampling.

Struwig and Stead (2013:293) have grouped the alternative types of sampling into probability and non-probability sampling techniques. Probability sampling is a process of selecting a sample using a sample technique that permits the researcher to specify the probability or chance that each member of the targeted population will be selected for sample (Jonker & Pennink,

2010:124). Conversely, non-probability sampling is “a sampling technique in which units of the sampling are selected based on personal judgement or convenience” (Struwig & Stead, 2013).

This type of sampling (non-probability) is efficient in the use of available resources and is always available to work with (Jonker & Pennink, 2010:124). This empirical survey has employed random sampling and the sample population was a census of all the 150 third year students.

The researcher opines that the third year science education students can best provide the required experiences on the entire curriculum with specific focus on the science education curriculum. Therefore, for this specific survey, the term population means all the third year science education students, including those that participated in the pre-test.

In this section, the researcher has looked at the sample selection. Linked to this, sample size is elaborated next.

3.5.1 Sample size

Sample size determination is the act of selecting the number of discoveries or repetition to put in a statistical sample (Bartiett, Kotrik& Higgins, 2010:50). Bartiett, et al. (2010:50) also emphasise that the sample size is an essential characteristics of a study that employs observation that aims at having conclusions about a population from a sample. Bradley (2008:170) suggests that the correct sample size is determined by the accuracy of the study and responsible choice of the respondents.
Slavin and Smith (2009:3) opine that it often has been seen that studies having a small sample size are likely to be more effective than those with larger sizes. According to Bartiett, *et al*. (2010:51), the following ways may be used to select a sample size:

- Expedience – for example, include those items readily available or convenient to collect;
- Using a target variance for an estimate to be derived from the sample eventually obtained; and

- Using a target for the power of a statistical test to be applied once the sample is collected.

In this empirical (quantitative survey), the target population was150 third year science students. All the 150 third year students participated because they were able to provide the information as required from the researcher. These respondents are in an ideal position to provide fruitful responses on the entire science education curriculum.

Data analysis will now be discussed to indicate how the researcher will “arrive” at the outcomes of this study.

3.6 DATA ANALYSIS

Data analysis is “a way of making differences between data processing and cleaning” (Ader, Mellenbergh & Hand, 2008:333). Aderetal. (2008: 26) states that data analysis is essential when one needs to identify useful knowledge and help in the decision making process. According to Mellenbergh (2009:102), data analysis is “a systematic way of applying statistics and logic with the end sought of explaining and data evaluation”. To ensure data integrity, the exact and correct analysis of research findings is crucial. In addition, Zikmund (2010:98) states that this process starts with writing down the information obtained from literature review, interviews and questionnaires.

The Statistical Package for Social Sciences (SPSS) had been used to analyse the data.
In section C of the questionnaire, the respondents provided comments and suggestions regarding the curriculum and the training provided at the college. This was then reported according to the following categories: content, experiential learning and content delivery.
The above has explained in details how the collected data was analysed. The researcher will now discuss the role of validity and reliability with specific reference to the empirical study.

3.7 VALIDITY AND RELIABILITY

Validity is a concept that describes what a questionnaire or test measures and what it was designed to measure (Brains, et al., 2011:105). Reliability is a concept that informs more about consistency in measurement (Lichtenwald, 2011:121). A questionnaire or test is reliable when one gets similar outcomes even when the questionnaire and test is re-administered.

According to Kartz (2009:26), different types of validity and reliability are considered when conducting a quantitative research. Validity is categorised into: face validity, content validity, criterion validity and construct validity. Content validity had been applied in this research because the content of the measuring instrument was considered, in terms of whether it provided adequate coverage of the topic under study. A panel of experts (Statistician, Supervisor, and Co-supervisor) were consulted to validate the questionnaire as this will ensure that the data collected answer the research questions.

In reliability, the instrument (the questionnaire) should measure the same when under the same conditions with similar subjects (Kartz, 2009:27). The researcher can ascertain if an instrument is reliable when the respondent's scores remain in the same order for each administration or measurement. Scale reliability tests were conducted on the nine (9) aspects of career readiness and this was shown in section 4.4.10 in chapter four (4).

Five (5) respondents (students) from the Nazarene Teachers College were requested to participate in the pilot study and their feedback was used to refine the final questionnaire.

The researcher discussed the issues of validity and reliability in this section. Ethics that have to be taken into considerations will now be discussed.

3.8 ETHICAL CONSIDERATIONS

The researcher is a staff member of the Nazarene Teachers College. Therefore, it is important to focus on the ethical considerations of executing the research study. Mouton (2006:239) states that the ethics of science considers what is not correct and correct when conducting a study, and also when looking for the truth. The researcher should be one that adheres to required

norms and values. The researcher argues that conduct should be at the required standard of ethics when carrying out the study. The ethical clearance certificate has been obtained from the College of Education (CEDU) at the University of South Africa (UNISA) (See the ethical clearance certificate attached (see Appendix E).

The researcher has written letters to both the Director of Education and the Principal of the Nazarene Teachers College requesting their permission for conducting the study (see Appendix C and Appendix D respectively). The information letter to the students to provide them with the assurance of anonymity regarding their identities with regard to the data they have provided (see Appendix B). Strydom (2008:62) states that confidentiality entails using the data collected confidentially while anonymity looks at the respondent's privacy.

The researcher has written letters to the final year students of the Nazarene Teachers College requesting the students to take part in the study. The students signed the consent form (see Appendix F) showing their willingness to take part in the study. The researcher indicated that the respondents should not write their names on the questionnaires and, whatever information collected from them will not be revealed to anybody and will only be used for the purposes in this study. The respondents were given the assurance that they can see the outcomes of the study any time they wish. The researcher has carefully stored the evidence and will keep this evidence for a period of at least five years in a safe and secure place. A copy of the results of the study will be given to the management of the Nazarene Teachers College after the study has been completed.

3.9 CONCLUSION

In this chapter, the methodology used in this study was explained. This encompasses the research design, data collection, population, data analysis and the ethical considerations. An empirical study was conducted by employing a self-administered questionnaire to allow respondents to answer questions related to the research. The Likert-scale and open-ended type of question items were used to collect the data. The third year students of Nazarene Teachers College were the 'target population'79%were the respondents. Data analysis was described to

indicate how the conclusions were achieved. Lastly, ethical measures that guided the collection of data have been discussed.

Chapter 4, which comprises the presentation and the analysis of data, will now be discussed with specific focus on the main research question asked in section 1.5.2.1 namely: How do the final year students evaluate their career readiness after completing the science education course at the Nazarene Teachers College? The research sub-questions have also been taken into account as asked in section 1.5.2.1.

The data analysis and interpretation of the empirical findings will now be discussed in the next chapter.

CHAPTER 4
DATA ANALYSIS AND INTERPRETATION OF THE FINDINGS

Figure 7: Visual presentation: structure of chapter 4

4.1 INTRODUCTION

The previous chapter described the research design and methodology of this study, the research approach, research design, data collection, questionnaire design, sample selection, data analysis and ethical consideration.

This chapter presents the empirical findings of the study, including the interpretation of the results. It begins with describing the biographical information of the students. This is followed by the respondents' responses to the questionnaire items that probe the various career readiness concepts; describing how reliably these sets of questionnaire items measure the concepts; finding perception scores from the subset of responses supplied to the questionnaire questions; perception scores and mean of the scores; overall career readiness measure and effect of biographical properties on the perceptions of respondents.

This is then followed by summary of the students' (respondents') responses to the open-ended questions on the questionnaire and interpretation of the findings.

4.2 RESEARCH QUESTIONS

The main research question can be summarised as follows:

- How do the final year students evaluate their career readiness after completing the science education course at the Nazarene Teachers College?

The sub-research questions that were further taken into account were:

- How do students rate their training in terms of their attitudes towards science teaching?
- How do students rate their training regarding science teaching skills?
- How do students rate their training regarding their ability to teach science processes?
- How do students rate their training in terms of their ability to use appropriate science teaching methods?

- How do students rate their training in terms of their capability to prepare science teaching aids/resources?
- How do students rate their training regarding their competence in facilitating learner-centred pedagogy?
- How do students rate their training regarding their questioning skills and a sound knowledge base in science teaching?
- How do students rate their training regarding their awareness of the nature of science for society?
- How do students rate their training regarding their career readiness according to their biographical information?
- How do students rate their training regarding career readiness taking possible biographical effects into account?

The demographic analysis of the respondents will now be discussed.

4.3 DEMOGRAPHIC ANALYSIS

Christensen, Johnson and Turner (2011: 483-484) state that research data that is represented in frequency tables serve to supplement the research results by assisting to explain these findings. Beins and McCarthy (2012: 77) support this. The researcher proceeded to make use of frequency tables in the demographic analysis as seen in the underneath Table 4.1.

Table 4.1: Biographical background

Gender				
Gender	**Frequency**	**Percent**	**Cumulative frequency**	**Cumulative percent**
Male	42	38.53	42	38.53
Female	67	61.47	109	100.00
Frequency missing = 2				

Age				
Age	**Frequency**	**Percent**	**Cumulative frequency**	**Cumulative percent**
19-24 years	19	17.27	19	17.27
25-27 years	62	56.36	81	73.64
> 27 years	29	26.36	110	100.00
Frequency missing = 1				

Experience				
Experience	**Frequency**	**Percent**	**Cumulative frequency**	**Cumulative percent**
0-1 years	88	80.00	88	80.00
2-3 years	8	7.27	96	87.27
4-5 years	2	1.82	98	89.09
6-7 years	2	1.82	100	90.91
> 7 years	10	9.09	110	100.00
Frequency missing = 1				

Finance study				
Finance Study	**Frequency**	**Percent**	**Cumulative frequency**	**Cumulative percent**
Paid for studies	5	4.55	5	4.55
Used a bursary	105	95.45	110	100.00
Frequency missing = 1				

Science				
Science	**Frequency**	**Percent**	**Cumulative frequency**	**Cumulative percent**
Yes	108	98.18	108	98.18
No	2	1.82	110	100.00
Frequency missing = 1				

Gender				
Gender	**Frequency**	**Percent**	**Cumulative frequency**	**Cumulative percent**

Area				
Area	**Frequency**	**Percent**	**Cumulative frequency**	**Cumulative percent**
urban area	31	28.18	31	28.18
rural area	79	71.82	110	100.00
Frequency missing = 1				

Certificate				
Certificate	**Frequency**	**Percent**	**Cumulative frequency**	**Cumulative percent**
Matric/A level/other	37	33.64	37	33.64
SGCSE	73	66.36	110	100.00
Frequency missing = 1				

Completed				
Completed	**Frequency**	**Percent**	**Cumulative frequency**	**Cumulative percent**
1-3 years ago	19	17.27	19	17.27
4-7 years ago	72	65.45	91	82.73
> 8 years ago	19	17.27	110	100.00
Frequency missing = 1				

Table 4.1 gives an overview of the respondents' biographical background as the items appeared in the questionnaire. The table shows that 38.53% of the respondents were *males* and 61.47% were *females*. The majority of the respondents (56.36%) fell in the 25-27 year age group, followed by those above 27 years of age with 26.36%. Therefore, most of the respondents are mature students with ages between 25-30 years. Respondents reported teaching practice experience of less than a year (80%) and also that they used a bursary to finance their studies at the Nazarene Teachers College (95.45%). Only 4.55% of the respondents paid for their studies.

The majority of the respondents 98.18% have studied science at high school, and also reside in rural areas (71.82%). Only 28.18% of the respondents reside in an urban area. Most of the respondents were in possession of the Swaziland General Certificate in Secondary Education

(66.36%), 33.64% were in possession of other certificates. In addition, 65.45% of the respondents have completed high school 4-7 years ago, 17.27% have completed high school 1-3years ago and more than 8 years ago.

The researcher will now present the findings of a descriptive analysis of the respondents' responses to the groups of questionnaire items that probe each of the nine career-readiness concepts.

4.4 DESCRIPTIVE ANALYSIS OF THE RESPONSES PROBING EACH OF THE NINE CAREER READINESS CONCEPTS

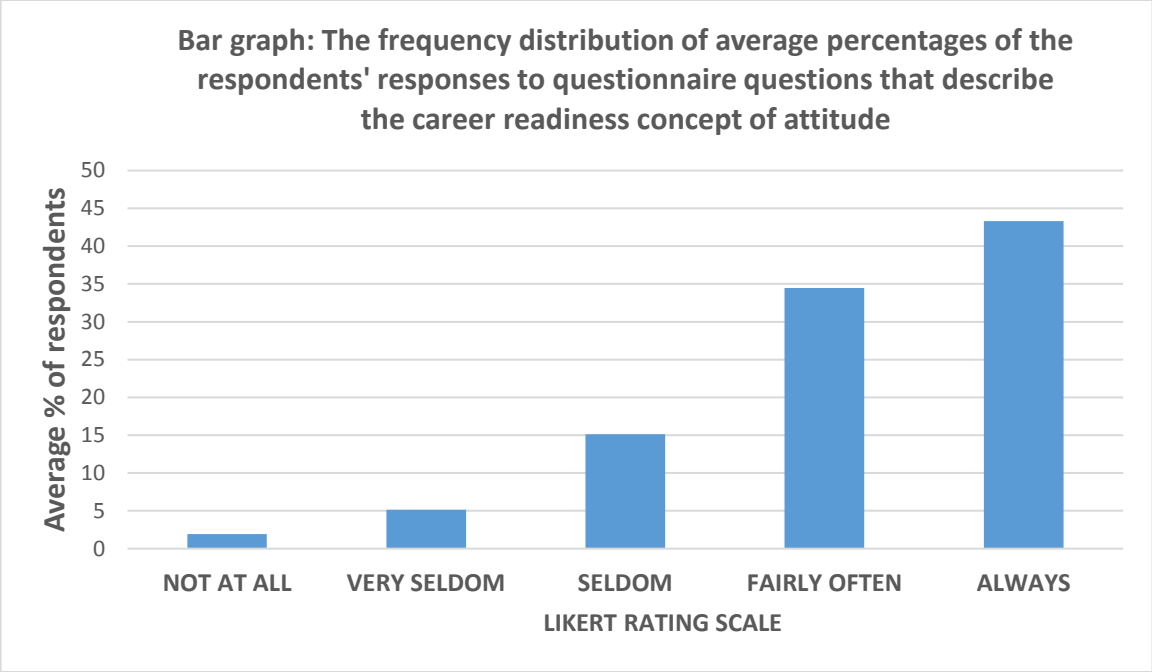
For interpretation purposes, the focus was on the last row of each of the tables of total responses starting with Table 4.2 and corresponding bar graph of the totals in the table below.

4.4.1 The career readiness concept of attitude

The researcher will now present the findings of a descriptive analysis of the respondents' responses to the career readiness concept of attitude as seen in Table 4.2 and the corresponding bar graph that follows.

Table 4.2: The frequency distribution of the respondents' responses to questionnaire questions that describe the career readiness concept of attitude

Questionnaire item	Frequency of occurrence rating					
Frequency Row Pct.	Not at all	Very seldom	Seldom	Fairly often	Always	Total
To be positive towards Science	1 0.93	3 2.80	14 13.08	36 33.64	53 49.53	107
To have a sense of wonder/fascination re. Science	2 1.90	10 9.52	21 20.00	51 48.57	21 20.00	105
To share the wonder of Science with learners	1 0.92	8 7.34	18 16.51	37 33.94	45 41.28	109
To be fascinated because lecturers instilled a sense of wonder	8 7.34	10 9.17	26 23.85	39 35.78	26 23.85	109
To inspire learners to find answers to Science questions	1 0.91	9 8.18	18 16.36	36 32.73	46 41.82	110
To provide prompt feedback to learners questions	2 1.83	7 6.42	7 6.42	33 30.28	60 55.05	109
To create diverse learning opportunities for learners	1 0.91	5 4.55	15 13.64	42 38.18	47 42.73	110
To be a positive change-agent for promotion of Science to learners	2 1.83	1 0.92	22 20.18	32 29.36	52 47.71	109
To develop a positive attitude towards Science in learners	2 1.82	3 2.73	14 12.73	23 20.91	68 61.82	110
To instil increased interest in Science	3 2.75	5 4.59	14 12.84	39 35.78	48 44.04	109
To inspire learners to participate readily in Science activities	2 1.83	2 1.83	11 10.09	37 33.94	57 52.29	109
To appreciate the value, science discussions with learners	0 0.00	4 3.67	18 16.51	45 41.28	42 38.53	109
Total	25 1.92	67 5.13	198 15.17	450 34.48	565 43.30	1305 100.00
Frequency Missing = 27						



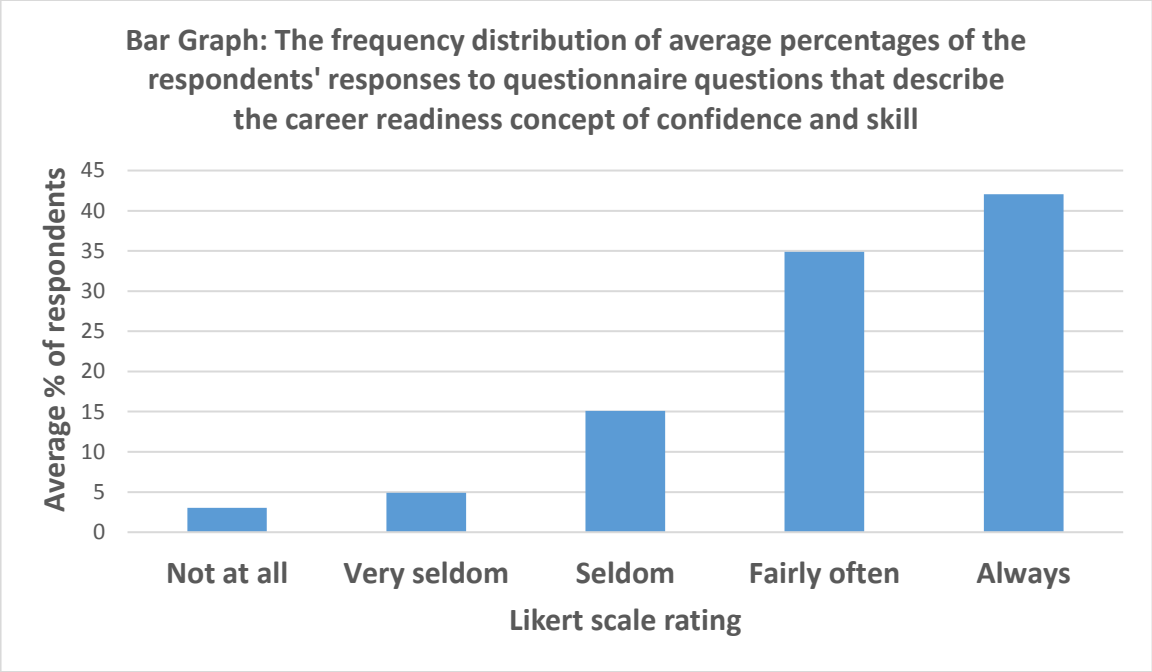
The highest frequencies were considered and their position in the Likert rating scale: not at all, very seldom, seldom, fairly often, and always. The respondents were asked to indicate their responses to the questions that probe career readiness concept of attitude. A total of 77.78% (34.48 + 43.30) of the respondents reported that they felt that the course influenced their attitude positively towards the teaching of science. This suggests that the course had a positive effect on respondents' attitude. Only 20.3% (5.13 + 15.17) of the respondents experienced that the course rarely strengthened their attitudes. This is evident in Table 4.2 and bar graph above. The respondents reported that the training received has changed their attitude towards science. The respondents expressed that they can now engage learners in activities and have developed love for pupils, thus understand their scientific problems. They also reported that they now work hand in hand with learners to discover facts about science. To support what the respondents have said, Reiser (2009:56) postulates that teachers who have developed a positive attitude towards science will encourage active learning and promote co-operation among learners.

4.4.2 The career readiness concept of confidence and skills

The researcher will now present the findings of a descriptive analysis of the respondents' responses to the career readiness concept of confidence and skills as seen in Table 4.3and the corresponding bar graph of the totals in the table that follows.

Table 4.3: The frequency distribution of respondents' responses to questionnaire items that describe the career readiness concept of confidence and skills to teach science

Questionnaire item	Frequency of occurrence rating					
Frequency Row Pct.	Not at all	Very seldom	Seldom	Fairly often	Always	Total
Clear explanation of basic scientific principles to learners	6 5.45	7 6.36	14 12.73	45 40.91	38 34.55	110
Self-understanding and thus ability explain basic scientific principles	2 1.83	8 7.34	19 17.43	36 33.03	44 40.37	109
To develop confidence in formulating higher order questions	2 1.82	1 0.91	16 14.55	22 20.00	69 62.73	110
Allows application of learner centred approach	0 0.00	1 0.91	17 15.45	42 38.18	50 45.45	110
Respond confidently, learner-questions Science curriculum content	4 3.64	9 8.18	12 10.91	43 39.09	42 38.18	110
Develop an ability to guide learners. problem solving skills	4 3.74	4 3.74	10 9.35	43 40.19	46 42.99	107
Develop an ability to apply the discovery approach	3 2.80	4 3.74	21 19.63	41 38.32	38 35.51	107
Develop an ability to apply the transactional approach	10 9.17	7 6.42	18 16.51	38 34.86	36 33.03	109
Develop an ability to introduce different laboratory equipment	5 4.55	7 6.36	15 13.64	43 39.09	40 36.36	110
Develop an ability to facilitate learning experience via investigation	3 2.73	4 3.64	24 21.82	38 34.55	41 37.27	110
Develop a foundation to facilitate learners understanding of basic concepts	0 0.00	7 6.42	19 17.43	33 30.28	50 45.87	109
Confidence to explain to learners the world around us	1 0.92	5 4.59	13 11.93	33 30.28	57 52.29	109
Total	**40** **3.05**	**64** **4.89**	**198** **15.11**	**457** **34.89**	**551** **42.06**	**1310** **100.00**
Frequency Missing = 22						



The respondents were asked to indicate their responses to the questions that probe career readiness concept of confidence and skills. A similar deduction was followed as in 4.4.1. Most of the respondents (34.89 + 42.06 = 76.95%) agreed that the course influenced their confidence and skills to teach primary school learners as indicated in Table 4.3 and the corresponding bar graph above. A total of 20% (4.89 + 15.11) of the respondents reported that the course rarely influenced their confidence and skills to teach primary school leaners. The respondents felt satisfied with the training acquired and thus will teach science with confidence at the primary school. To add on what the respondents say, Gursen Otacioglu (2010:315) points out the level of uncertainty that arises if confidence in teaching is lacking. It is important for a science teacher to have proper skills and confidence and this is provided by good quality continuing professional development (McCarthy & Youens, 2009:149).

4.4.3 The career readiness concept of the scientific processes

The researcher will now present the findings of a descriptive analysis of the respondents' responses to the career-readiness concept of the scientific processes as seen in Table 4.4and corresponding bar graph of the totals in the table.

The respondents were asked to indicate their responses to the questions that probe career readiness concept of the scientific process. A similar deduction as in 4.4.1.was followed. A total of 74.33% (34.63 +39.90 = 74.33%) of the respondents elicited that they were influenced by the course to use the processes of science when teaching primary school learners. In addition, 22.67% of the respondents indicated that they were infrequently influenced by the course to use the processes of Science when teaching. This is evident in the table and corresponding bar graph of the totals in the table below.

The respondents remarked that the training they received has provided them with scientific process skills and confidence in the use of these skills. One of them has this to say:

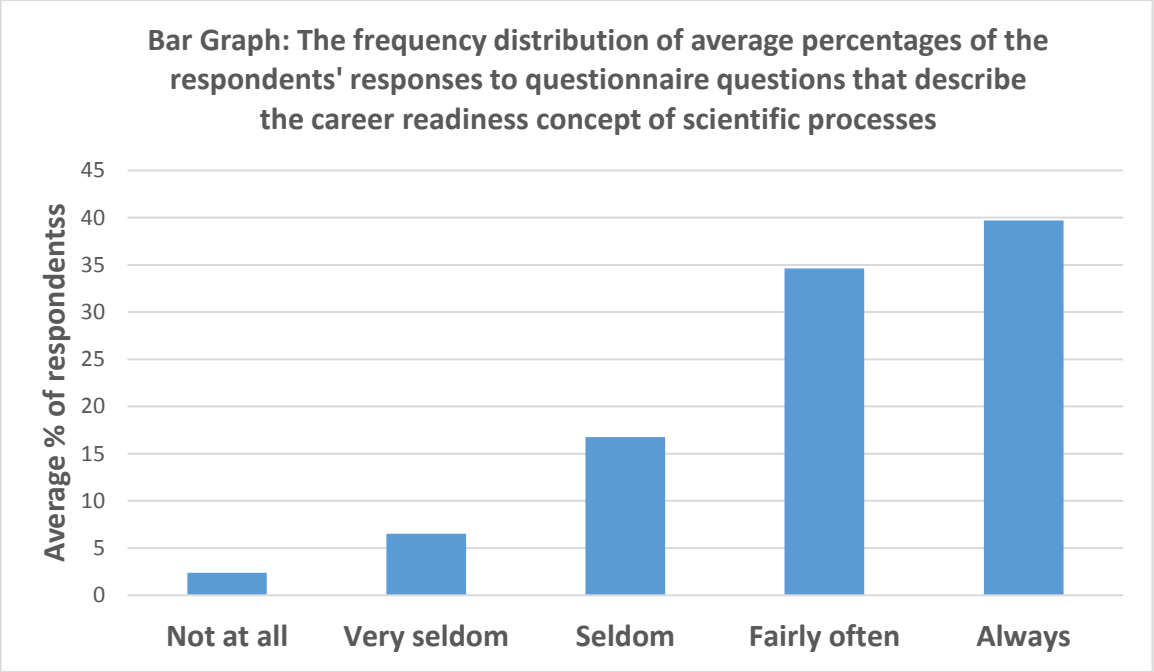
> "…*the practice of science process skills makes us understand the nature of science. Also teachers must be taught how to activate each of these in pupils (learners) effectively.*"

Another respondent reported that the process skills have helped them differentiate between observations and inferences.

Science process skills are the tools which scientists and those preparing to become scientists use when teaching. Mashile (2007:96) elicited that the nature of process skills is complex and comprises three-related domains, namely, the processes scientists use in investigating the natural world; the cognitive processes involved in learning science and the pedagogical procedures taking place in the classroom.

Table 4.4: The frequency distribution of respondents' responses to questionnaire items that describe the career readiness concepts of the scientific processes

Questionnaire items	Frequency of occurrence rating					
Frequency Percent Row Pct.	Not at all	Very seldom	Seldom	Fairly often	Always	Total
Ability to encourage use, basic scientific techniques	3 2.73	7 6.36	13 11.82	36 32.73	51 46.36	110
Ability to plan fieldwork, collect data re. natural phenomena	3 2.75	6 5.50	26 23.85	45 41.28	29 26.61	109
Ability facilitate field work to collect data re natural phenomena	3 2.73	8 7.27	28 25.45	44 40.00	27 24.55	110
Ability teach observational skills, e.g. seasons	1 0.91	9 8.18	17 15.45	41 37.27	42 38.18	110
Ability to teach classification skills, e.g. sort objects	3 2.73	8 7.27	9 8.18	44 40.00	46 41.82	110
Encourages lesson planning for teaching Science skills, learner centeredness	2 1.83	2 1.83	19 17.43	27 24.77	59 54.13	109
Encourages lesson planning for developing Science skills, learner-centred	3 2.75	2 1.83	14 12.84	26 23.85	64 58.72	109
Ability facilitate practical activities for Science process skills	1 0.93	8 7.41	10 9.26	43 39.81	46 42.59	108
Ability to facilitate development of complex skill of data interpretation	4 3.64	10 9.09	28 25.45	33 30.00	35 31.82	110
Confidence to teach higher order skills, e.g. question formulation	2 1.82	13 11.82	22 20.00	38 34.55	35 31.82	110
Ability to teach skill, recording results effectively	4 3.67	6 5.50	17 15.60	43 39.45	39 35.78	109
Ability to teach skills, communicating findings effectively	3 2.78	9 8.33	22 20.37	31 28.70	43 39.81	108
Ability to understand, process skills jointly define process, investigation	2 1.82	10 9.09	20 18.18	45 40.91	33 30.00	110
Understand the value of developing learners process skills	2 1.85	5 4.63	22 20.37	35 32.41	44 40.74	108
Ability to view science as process and as knowledge	3 2.73	4 3.64	89 7.27	37 33.64	58 52.73	110
Total	**39** **2.38**	**107** **6.52**	**275** **16.77**	**568** **34.63**	**651** **39.70**	**1640** **100.00**
Frequency Missing = 22						

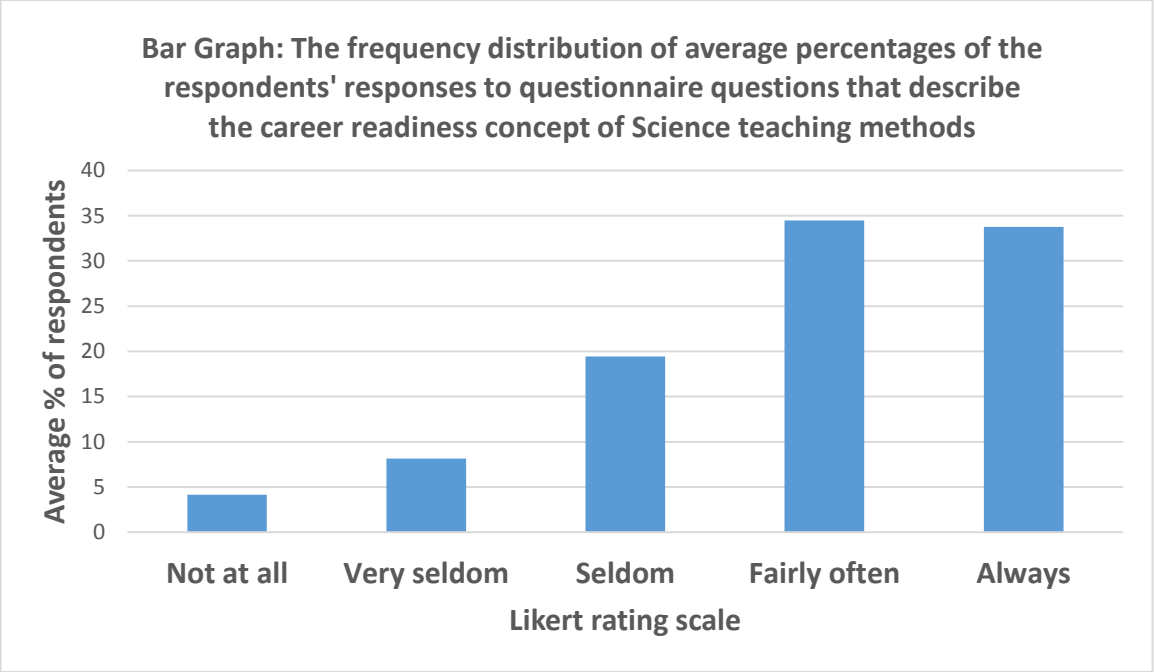


4.4.4 The career readiness concept of science teaching methods

The researcher will now present the findings of and a descriptive analysis of the respondents' responses to the career-readiness concept of science teaching methods as seen in table 4.5 and corresponding bar graph of the totals in the table that follow.

Table 4.5: The frequency distribution of respondents' responses to questionnaire items that describe the career readiness concepts of science teaching methods

Questionnaire items	Frequency of occurrence rating					
Frequency Row Pct	Not at all	Very seldom	Seldom	Fairly often	Always	Total
Ability to convey scientific principles via demonstrations	5 4.59	6 5.50	16 14.68	35 32.11	47 43.12	109
Ability to convey scientific principles via fieldwork	4 3.67	6 5.50	24 22.02	52 47.71	23 21.10	109
Confidence to teach using the project method approach	8 7.34	15 13.76	30 27.52	32 29.36	24 22.02	109
Ability to use the circus approach	15 14.15	15 14.15	29 27.36	25 23.58	22 20.75	106
Confidence to use the discovery approach	0 0.00	6 5.66	19 17.92	44 41.51	37 34.91	106
Ability to plan fieldwork approach, any class size	7 6.36	9 8.18	27 24.55	38 34.55	29 26.36	110
Ability to apply fieldwork approach any class size	7 6.42	10 9.17	28 25.69	35 32.11	29 26.61	109
Ability to limit chalk and talk approach- teacher centred	5 4.55	9 8.18	16 14.55	32 29.09	48 43.64	110
Ability to use local learning experiences and resources	1 0.92	9 8.26	24 22.02	39 35.78	36 33.03	109
Ability to use interchangeable learning styles, manage large classes	3 2.75	2 1.83	20 18.35	37 33.94	47 43.12	109
Ability to facilitate concept-learning through tools, e.g. c mapping	2 1.82	7 6.36	18 16.36	53 48.18	30 27.27	110
Ability to encourage active learning via collaborate/ co-operative learning	3 2.78	9 8.33	18 16.67	31 28.70	47 43.52	108
Ability to diagnose misconceptions, scientific concepts	1 0.93	11 10.19	16 14.81	35 32.41	45 41.67	108
Understanding the role of insight and prior conceptions to learn scientific concepts	2 1.82	10 9.09	11 10.00	37 33.64	50 45.45	110
Total	63 4.14	124 8.15	296 19.45	525 34.49	514 33.77	1522 100.00
Frequency Missing = 32						



For interpretation purposes, a similar way as in 4.4.1 was followed. Most of the respondents did not seem to apply these teaching methods in their classrooms. This is indicated by a total of 68.26% (34.49 + 33.77), which is less than 70%. The respondents indicate that the specific training that they have received has failed to address the circus approach method of teaching science. Some of the respondents reported that the training emphasizes the use of different learning methods to accommodate all the learners in the classroom. Another respondent felt that the training enables him or her to use the spiral approach method of teaching science. One respondent even reported that the integrated method of teaching should be used in all the courses at the College instead of relying mainly on the lecture method.

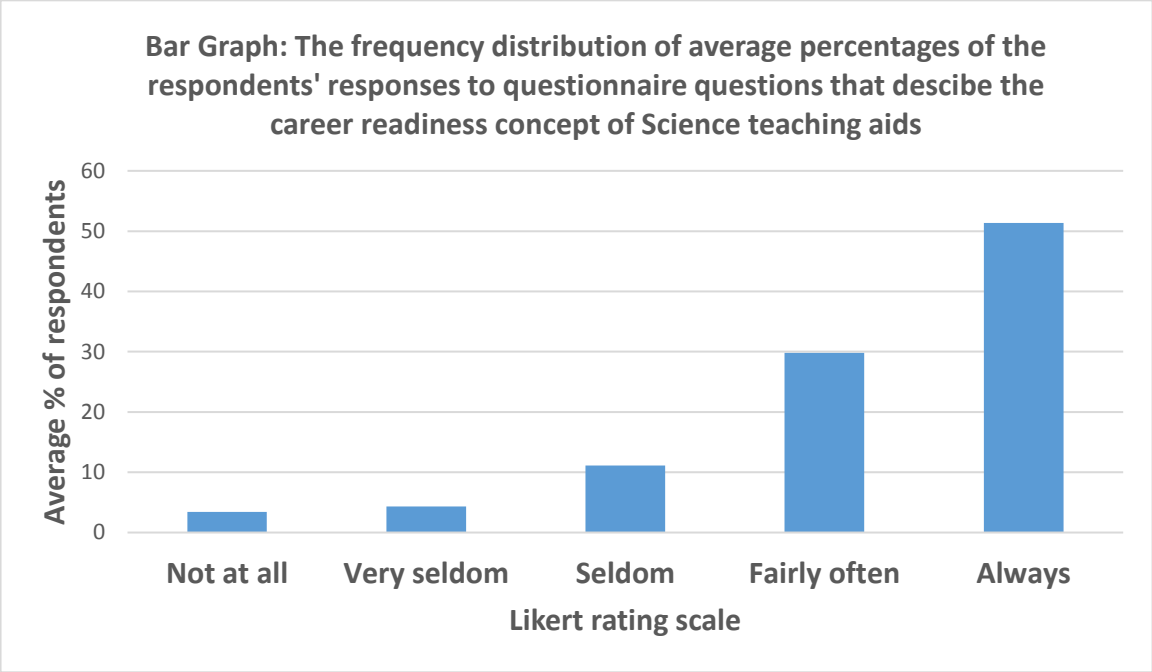
To support these responses, Biggs (2010:58) states that teachers who use a range of teaching approaches (teaching methods) create a positive learning environment and are able to communicate necessary skills and concepts in a way that the students (respondents) will be better able to understand. According to Jones (2010:214), having a range of skills appropriate for science teaching increases student engagement and understanding of the learning material taught.

4.4.5 The career readiness concept of the use of science teaching aids

The researcher will now present the findings of a descriptive analysis of the respondents' responses to the career readiness concept of the use of science teaching aids as seen in table 4.6and the corresponding bar graph of the totals in the table that follow.

Table 4.6: The frequency distribution of respondents' responses to questionnaire items that describe the career readiness concepts of the use of science teaching aids

Questionnaire items	Frequency of occurrence rating					
Frequency Row Pct	Not at all	Very seldom	Seldom	Fairly often	Always	Total
Ability to use improvised aids, teach scientific concepts	2 1.83	5 4.59	13 11.93	24 22.02	65 59.63	109
Ability to find aids, e.g. some magnet to teach magnetism	3 2.75	3 2.75	14 12.84	36 33.03	53 48.62	109
Ability to provide interactive learning as intro to teach concept of mass	4 3.67	8 7.34	25 22.94	35 32.11	37 33.94	109
Ability to improvise scientific equipment via transformation of objects	6 5.50	5 4.59	15 13.76	40 36.70	43 39.45	109
Creativity to source improvised apparatus, e.g. bottle tops as watch glasses	7 6.42	7 6.42	11 10.09	37 33.94	47 43.12	109
Confidence to prepare experiments	3 2.80	4 3.74	10 9.35	32 29.91	58 54.21	107
Confidence to conduct experiments safely	3 2.78	3 2.78	14 12.96	29 26.85	59 54.63	108
Safety-awareness re. chemicals and heat	3 2.78	5 4.63	7 6.48	26 24.07	67 62.04	108
Correct procedures to use expensive lab apparatus appropriately	6 5.50	6 5.50	13 11.93	38 34.86	46 42.20	109
Ability to construct teaching aids for exciting learning opportunities	3 2.75	6 5.50	12 11.01	33 30.28	55 50.46	109
Awareness of learners. different learning styles	3 2.75	4 3.67	6 5.50	25 22.94	71 65.14	109
Use teaching material, locally sourced & familiar to learners	2 1.83	3 2.75	9 8.26	29 26.61	66 60.55	109
Consider learner characteristics when selecting teaching aids	3 2.75	2 1.83	8 7.34	37 33.94	59 54.13	109
Total	**48** **3.40**	**61** **4.32**	**157** **11.11**	**421** **29.79**	**726** **51.38**	**1413** **100.00**
Frequency Missing = 30						



The respondents were asked to indicate their responses to the items of the questionnaire that probe career readiness concept of Science teaching aids. For interpretation purposes, a similar way as in 4.4.1 was followed. A total of 81.17% (29.79 + 51.38) of the respondents reported that the course boosted their confidence to prepare science teaching aids for primary school learners. Only 15.43% of the respondents indicated that the course rarely boosted their confidence to prepare science teaching aids for the primary learners and 3, 4% indicated not at all. This is seen in the table and corresponding bar graph above. The respondents reported that the training they have received has equipped them with skills on how to construct science teaching aids. One of the respondents remarked that the use of teaching aids in science lessons is very crucial and should always be provided.

Another respondent mentioned that the training she has received helps her to rely less on expensive commercial teaching aids but to rather use those that can readily be constructed cheaply. Most of the respondents reported that teaching aids are very important and necessary for the learners to better understand specific scientific concepts. Another respondent mentioned: "*the training enables one to assign pupils to improve teaching aids.*" To support these responses, Reiser (2009:67) concurs that for science learners to enjoy their time in the

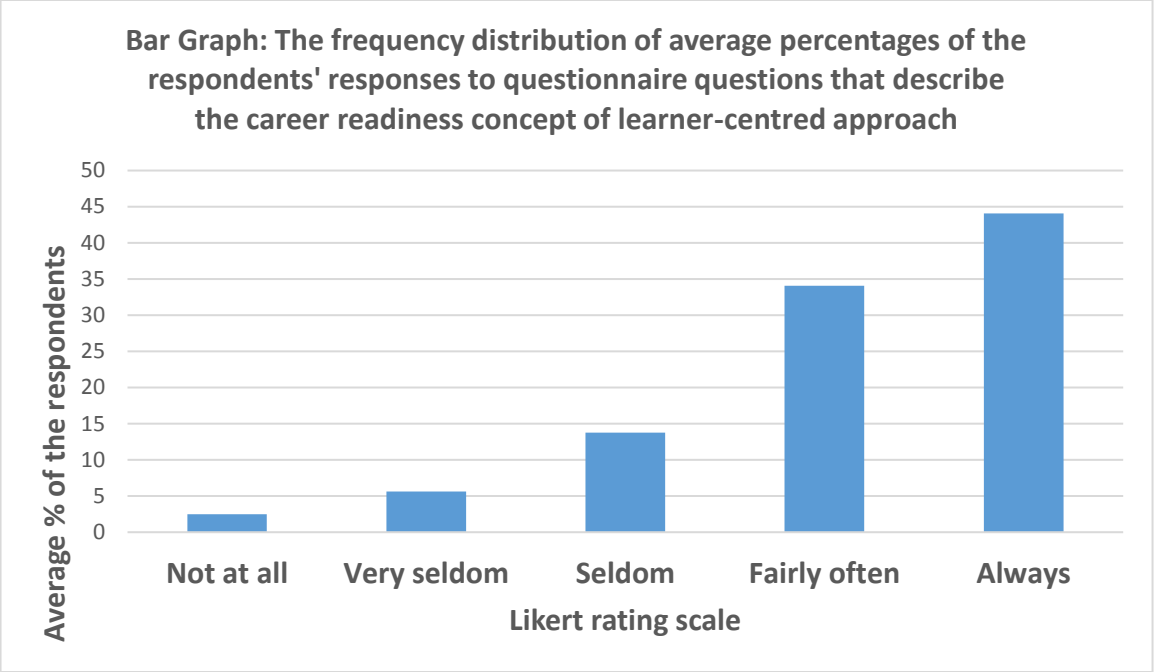
laboratory or classroom, the teacher must be confident in the preparation of teaching aids. The teaching aids and apparatus must be properly constructed. The teaching of science can be made more effective by the use of locally available teaching aids that teachers can access and construct if necessary.

4.4.6 The career readiness concept of a learner-centred approach

The researcher will now present the findings of a descriptive analysis of the respondents' responses to the career readiness concept of following a learner-centred approach to teaching science as seen in table 4.7and the corresponding bar graph of the totals in the table that follow.

Table 4.7: The frequency distribution of respondents' responses to questionnaire items that describe the career readiness concept of following a learner-centred approach to teaching science

Questionnaire items	Frequency of occurrence rating					
Frequency Row Pct.	Not at all	Very seldom	Seldom	Fairly often	Always	Total
Ability to exploit inquisitive nature of learners	9 8.41	10 9.35	15 14.02	34 31.78	39 36.45	107
Use class management skills during practicals and demonstrations	3 2.75	9 8.26	19 17.43	34 31.19	44 40.37	109
Aware of learner involvement in teaching and learning	1 0.93	5 4.67	14 13.08	33 30.84	54 50.47	107
Aware of the value of a harmonious relationship to the educational classroom climate	3 2.75	6 5.50	17 15.60	37 33.94	46 42.20	109
Ability to create experiences for collaborative learning	2 1.83	9 8.26	21 19.27	42 38.53	35 32.11	109
Ability to actively engage learners in learning experience	1 0.92	3 2.75	8 7.34	43 39.45	54 49.54	109
Consider learner ideas, preferences, learning styles, interests	3 2.75	4 3.67	14 12.84	37 33.94	51 46.79	109
Ability to monitor learners in collaborative/ co-operative approaches	2 1.83	9 8.26	20 18.35	41 37.61	37 33.94	109
Ability to formulate follow-up questions, correct incorrect answer given by learners	3 2.80	4 3.74	15 14.02	41 38.32	44 41.12	107
Take note of learners' non-verbal communication	6 5.56	8 7.41	19 17.59	39 36.11	36 33.33	108
Understand that learners construct their own meaning and learning experience	1 0.92	4 3.67	11 10.09	43 39.45	50 45.87	109
Recognise learners as individuals, e.g. call learners by name	1 0.93	3 2.78	10 9.26	18 16.67	76 70.37	108
Recognise learners as individuals, e.g. provide positive comments	0 0.00	5 4.59	11 10.09	38 34.86	55 50.46	109
Total	**35** **2.48**	**79** **5.61**	**194** **13.77**	**480** **34.07**	**621** **44.07**	**1409** **100.00**
Frequency Missing = 34						



For interpretation purposes, a similar way as in 4.4.1 was followed. Most of the respondents (34.07 + 44.07 = 78.14%) indicated that the course influenced their teaching to focus on the learner-centred approach. A total of 19.38% (5.61 + 13.77) of the respondents reported that the course rarely influenced their teaching to focus on a learner-centred approach and 2.48% were not at all influenced. This is evident in the table 4.7 and the corresponding bar graph above. The respondents opined that learners should be involved in all science activities and that the learner-centred approach should be used in the science education lessons. One of the respondents remarked that the use of the learner-centred approach allows learners to develop thinking skills and become critical thinkers.

The respondents reported that teachers should try and understand every learner's learning style because pupils learn differently. According to Armstrong (2012:102), student-centred learning represents both a mindset and culture within a given educational institution and is a learning approach, which is broadly related to and supported by constructivist theories of learning.

One of the respondents reported that the training received emphasizes that teachers should allow learners to discover things for themselves and construct their own knowledge. A teacher

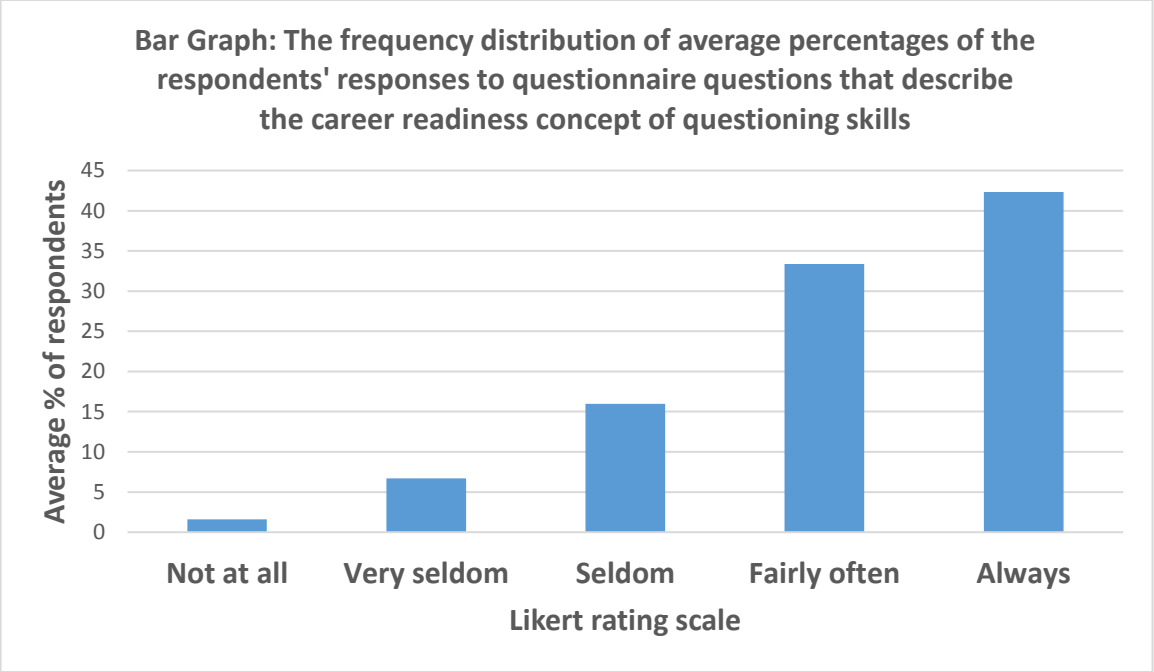
who utilizes inquiry-based student-centred instructional practices facilitates students' construction of knowledge (Douglas & Jaquith, 2009:55).

4.4.7 The career readiness concept of science questioning skills

The researcher will now present the findings of a descriptive analysis of the respondents' responses to the career-readiness concept of science questioning skills as seen in table 4.8and the corresponding bar graph of the totals in the table that follow.

Table 4.8: The frequency distribution of respondents' responses to questionnaire items that describe the career readiness concept of science questioning skills

Questionnaire items	Frequency of occurrence rating					
Frequency Row Pct.	Not at all	Very seldom	Seldom	Fairly often	Always	Total
Stimulate learner to ask/answer why-questions regarding scientific phenomena	5 4.63	8 7.41	15 13.89	35 32.41	45 41.67	108
Stimulate own desire to be curious and question scientific phenomena	2 1.83	11 10.09	20 18.35	38 34.86	38 34.86	109
Own ability to generalize from collected data	3 2.80	7 6.54	19 17.76	30 28.04	48 44.86	107
Formulate targeted questions, assessing learners(think, listen/learn)	2 1.87	13 12.15	17 15.89	32 29.91	43 40.19	107
Formulate graded questions using Bloom's taxonomy	0 0.00	4 3.67	15 13.76	29 26.61	61 55.96	109
Ability to minimize questions with one-word answers	3 2.78	6 5.56	13 12.04	48 44.44	38 35.19	108
Ability to encourage relevant questions from learners	0 0.00	8 7.41	12 11.11	39 36.11	49 45.37	108
Ability to develop inquiring/ problem-solving minds	0 0.00	4 3.70	22 20.37	31 28.70	51 47.22	108
Ability to elicit learners formulation of investigative problem statements	2 1.83	12 11.01	19 17.43	37 33.94	39 35.78	109
Ability to offer explanations based on observations from nature	1 0.93	5 4.63	19 17.59	39 36.11	44 40.74	108
Ability to use question and answer technique for learners for learning opportunities	2 1.85	5 4.63	14 12.96	41 37.96	46 42.59	108
Ability to formulate questions recollected and the recorded data of learners to be used	1 0.93	4 3.70	22 20.37	34 31.48	47 43.52	108
Total	**21** **1.62**	**87** **6.71**	**207** **15.96**	**433** **33.38**	**549** **42.33**	**1297** **100.00**
Frequency Missing = 35						



For interpretation purposes, a similar way as in 4.4.1 was followed**.** With regard to the respondents' responses to the questions that probe career readiness concept of questioning skills (33.38 + 42.33 = 75.71%) of the respondents reported that the course influenced their questioning skills. However, 22.67% indicated that the course did not often influence their questioning skills and 1.62% were not at all influenced. This is seen in the table 4.8 and the corresponding bar graph above. The respondents indicate that the training received provided respondents with the skill of constructing good questions during assessments. To support this response, Davis (2009: 16) argues that by asking good questions, the teacher can measure and evaluate the progress of learners with reference to thinking, listening and learning. One of the respondents pointed out that the training they received has fairly developed their questioning skills when assessing learners. Another respondent mentioned: "the training received instilled in me the attitude of refusing to answer questions I feel irrelevant to my lesson".

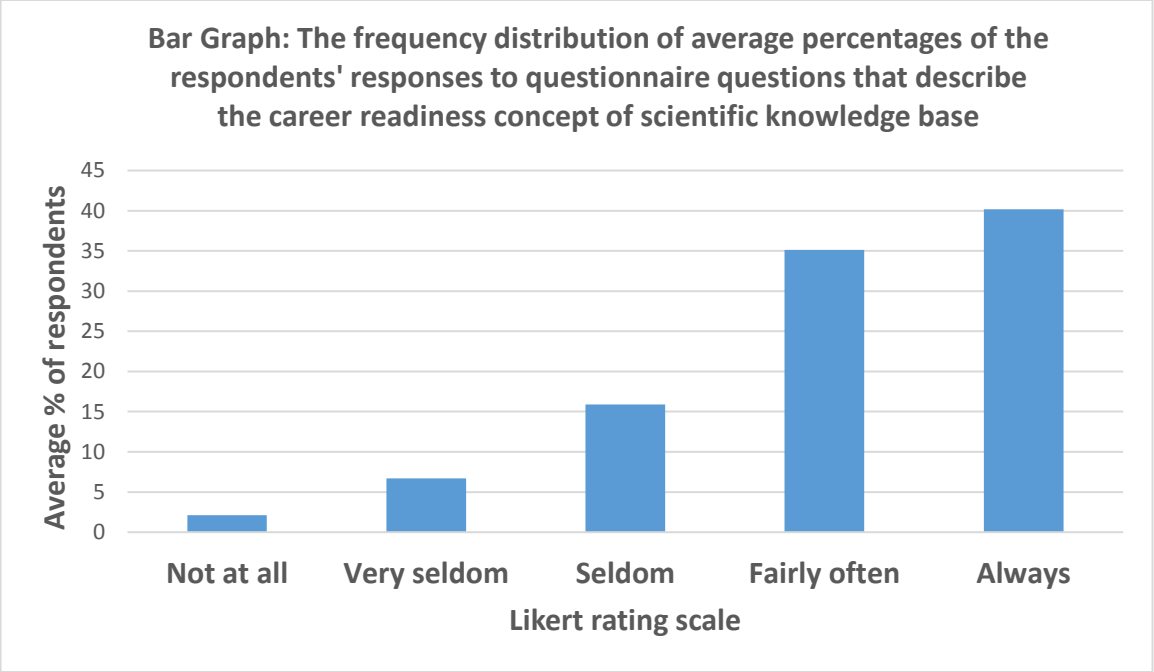
4.4.8 The career readiness concept of the contribution of a scientific knowledge base

The researcher will now present the findings of and a descriptive analysis of the respondents' responses to the career readiness concept of a sound scientific knowledge base to support the

teaching of science as seen in Table 4.9and the corresponding bar graph of the totals in the table that follow.

Table 4.9: The frequency distribution of respondents' responses to questionnaire items that describe the concept of a sound scientific knowledge base to support the teaching of science

Questionnaire items	Frequency of occurrence rating					
Frequency Row Pct.	Not at all	Very seldom	Seldom	Fairly often	Always	Total
Ability to use everyday examples to illustrate scientific principles	3 2.75	8 7.34	8 7.34	32 29.36	58 53.21	109
Ability to explain principles of electricity	3 2.78	8 7.41	22 20.37	45 41.67	30 27.78	108
Good command of subject matter and able to teaching a range of diverse learners	3 2.80	4 3.74	20 18.69	49 45.79	31 28.97	107
Confidence to teach Science as an expert teacher	2 1.89	4 3.77	21 19.81	37 34.91	42 39.62	106
Ability to use sources other than textbooks	2 1.87	6 5.61	17 15.89	35 32.71	47 43.93	107
Use TV news and documentaries to improve own science knowledge	3 2.75	12 11.01	25 22.94	33 30.28	36 33.03	109
Ability to source knowledge on indigenous plants, from many sources	2 1.83	7 6.42	17 15.60	27 24.77	56 51.38	109
Ability to anticipate possible misconceptions during lesson preparation	1 0.92	5 4.59	22 20.18	45 41.28	36 33.03	109
Ability to remediate misconceptions bound to arise	2 1.83	3 2.75	19 17.43	38 34.86	47 43.12	109
Reserve of content knowledge to be able to teach in primary school	3 2.78	9 8.33	15 13.89	43 39.81	38 35.19	108
Reserve of skills to teach Science in primary school	2 1.85	8 7.41	15 13.89	41 37.96	42 38.89	108
Ability to link Science concepts in a given topic	1 0.94	8 7.55	18 16.98	37 34.91	42 39.62	106
Ability to apply Science knowledge practically	2 1.87	10 9.35	10 9.35	34 31.78	51 47.66	107
Ability to structure subject matter to cater for most learning styles	3 2.80	9 8.41	11 10.28	34 31.78	50 46.73	107
Total	**32 2.12**	**101 6.69**	**240 15.90**	**530 35.12**	**606 40.16**	**1509 100.00**
Frequency Missing = 45						



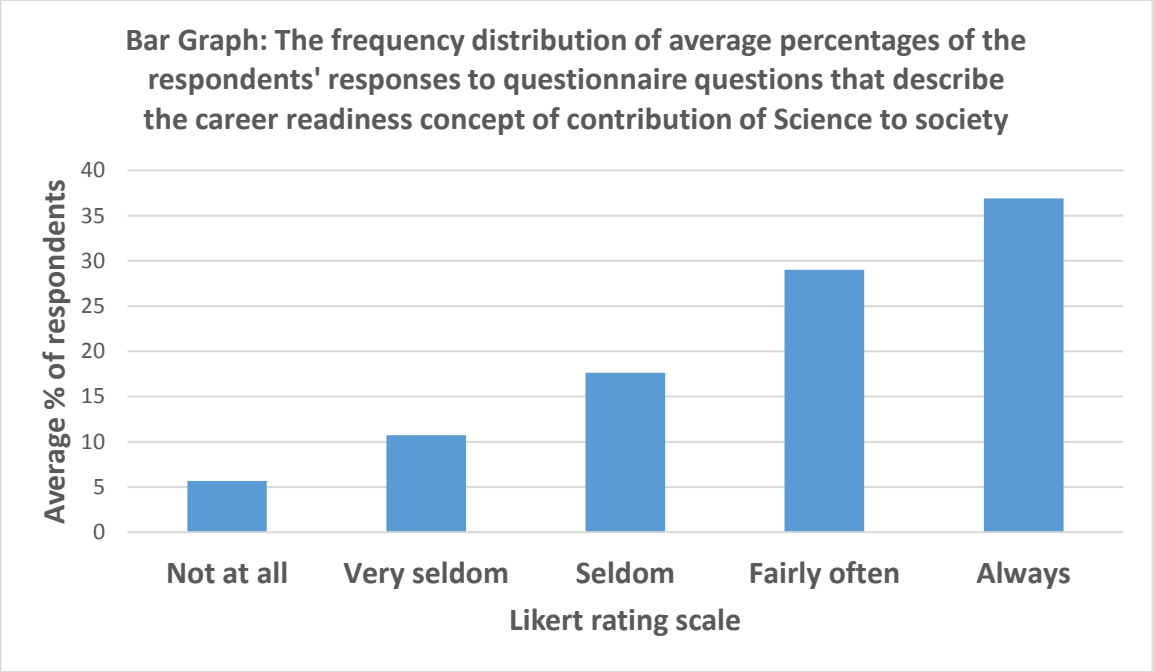
For interpretation purposes, a similar way as in 4.4.1.was followed. A total of 75, 28% (35.12 + 40.16) of the respondents showed that the course has provided them with a broad scientific knowledge base to teach the primary school learners. However, 22.59% indicated that the course infrequently provided them with a broad scientific knowledge base to teach learners. This is shown in Table 4.9 above. According to Taber (2011: 29), teachers should know more than their learners for them to teach effectively. He further states that a good science teacher should have a broad scientific knowledgebase through reading widely beyond lesson preparations.

4.4.9 The career readiness concept of the contribution of science to society

The researcher will now present the findings of a descriptive analysis of the respondents' responses to the career-readiness concept of conveying the contribution of science to society as seen in table 4.10 and the bar graph of the totals in the table.

Table 4.10: The frequency distribution of respondents' responses to questionnaire items that describe the concept of conveying the contribution of Science to society

Questionnaire items	Frequency of occurrence rating					
Frequency Row Pct.	Not at all	Very seldom	Seldom	Fairly often	Always	Total
Identify natural scientific processes that benefits society	6 5.50	17 15.60	10 9.17	31 28.44	45 41.28	109
Convey to learners how fascinating science is when applied to everyday life	3 2.78	9 8.33	23 21.30	31 28.70	42 38.89	108
Ability to use electronic media to show how science impacts our lives	6 5.61	10 9.35	23 21.50	35 32.71	33 30.84	107
Ability to convey how chemistry impacts the food industry	8 7.34	16 14.68	23 21.10	33 30.28	29 26.61	109
Ability to illustrate to learners impact of science everyday life	3 2.75	8 7.34	29 26.61	25 22.94	44 40.37	109
Ability to provide work for learners to address social/ environmental community problems	9 8.26	13 11.93	18 16.51	27 24.77	42 38.53	109
Inspire learners to integrate learning and living using science knowledge	2 1.83	5 4.59	22 20.18	39 35.78	41 37.61	109
Inspire learners to care for the environment using science knowledge	3 2.75	10 9.17	15 13.76	35 32.11	46 42.20	109
Ability to explain that diseases and epidemics can be combatted via science	13 11.93	10 9.17	21 19.27	28 25.69	37 33.94	109
Ability to compare/ contrast traditional and modern scientific practice	13 11.93	18 16.51	16 14.68	28 25.69	34 31.19	109
Encourage the search for new scientific breakthroughs, environmental issues	5 4.59	15 13.76	19 17.43	34 31.19	36 33.03	109
Own awareness that science can be used to engage with complex environmental issues	3 2.75	9 8.26	11 10.09	33 30.28	53 48.62	109
Total	**74** **5.67**	**140** **10.73**	**230** **17.62**	**379** **29.04**	**482** **36.93**	**1305** **100.00**
Frequency Missing = 27						



For interpretation purposes, a similar way as in 4.4.1 was followed. A total of 65. 97% (29.04 + 36.93) of the respondents experienced that the course has made them aware of the contribution of science to society. This means that the respondents were not so convinced of the contribution of Science to society as the number was less than 70%. In contrast, 28.35% (10.73 + 17.62) of them reported that the course has rarely made them aware of the contribution of Science to the society. A further 5.67% have shown that the course has not at all made them aware of the contribution of science to the society. This is indicated in table 4.10 above.

The qualitative responses indicate that learners should be taught the importance of science in their everyday lives and also encouraged teachers to read ahead so that they can access information on scientific concepts. Another respondent reported that science is applied everywhere in life. According to Carruthers (2008:106), science teachers should be able to use examples to explain how science has “changed” human beings’ way of life, for example better sanitation. Carruthers (2008:106) further states that science teachers should be empowered to practically illustrate to learners the value of science in everyday life.

4.4.10 The Scale reliability tests on the nine aspects of career readiness of science teachers

The researcher will now present a summary of scale reliability tests performed on respectively the responses of respondents to the nine subsets of questions that evaluate perceptions of the nine aspects of career-readiness of science teachers as seen in Table 4.11.

Table 4.11: A summary of scale reliability tests performed on respectively the respondents' responses to the nine subsets of questions that evaluate perceptions of the nine aspects of career readiness of science teachers

Construct	Subset of questionnaire questions	Questions removed/ inverted?	Standardised Cronbach alpha coefficient
Attitude	a1-a12	-	0.89
Confidence skills	b1-b12	-	0.90
Scientific process	c1-c15	-	0.93
Science teaching methods	d1-d14	-	0.93
Science teaching aids	e1-e13	-	0.93
Learner-centred approach	f1-f13	-	0.94
Questioning skills	g1-g12	-	0.92
Scientific knowledge base	h1-h14	-	0.93
Contribution society	i1-i12	-	0.95

Each row of table 4.11 reports the results of a separate analysis. This test measures the reliability of readiness concepts. It measures how reliably these sets of questionnaire questions measure the defined concepts (Golafshani, 2003:132). It also evaluates the relationship between question responses within a group of questionnaire questions to describe a certain concept.

For interpretation purposes, if the value of Cronbach alpha coefficient is in the region of 0.7 or greater than 0.7 but less than 1, it can be deduced that there was internal consistency reliability in that aspect of career readiness. The findings in the Table 4.11 below showed that all the questionnaire statements within a group of questionnaire questions truly contribute towards explaining the specific aspect of the research topic. The contribution of science to the society

reported a high internal consistency reliability (with 0.95), followed by the learner-centred approach concept (with 0.94), science teaching aids, scientific processes and scientific knowledge base and teaching methods (with 0.93). These aspects were followed by questioning skills, science teaching methods and lastly attitude. Overall, the questions jointly per aspect of the syllabus are significant as the results indicate no inappropriate questions in the questionnaire. This is evident in the table 4.11 above.

4.4.11 The overall mean score of the nine aspects of career readiness

The researcher will now present the overall means of the nine sets of the aspects of career readiness scores of the respondents as seen in table 4.12.

Table 4.12: The overall means of the nine sets of the aspects of career readiness scores of the respondents

Variable	N	Mean	Std Dev	Minimum	Maximum
Attitude	110	4.12	0.64	2.00	5.00
Confidence skills	110	4.08	0.70	2.17	5.00
Science process	110	4.02	0.73	1.60	5.00
Teach methods	110	3.85	0.76	1.86	5.00
Teach aids	109	4.21	0.74	1.00	5.00
Learner-centred	109	4.11	0.73	1.77	5.00
Question skills	109	4.07	0.73	2.33	5.00
Knowledge base	109	4.04	0.71	2.00	5.00
Contribute society	109	3.81	0.94	1.00	5.00

For interpretation purposes, mean scores approximating the value of 4 or the fairly often rating of the Likert scale of the questionnaire denoted a ready perception in different aspects for their careers. The values under a mean of 4.00 indicate a negative general perception from students. This applies to teaching methods as well as contribution of science to society.

The respondents felt somewhat more convinced that they benefitted more on the readiness aspect of the use of teaching aids with a score mean of 4.21, followed by the readiness aspect

on the change of attitude towards science when teaching with 4.12 and the readiness aspect of focusing on a learner-centred approach with 4.11. This is shown by the table 4.12 above.

4.4.12 The Differences in perceptions of the aspects according to the different biographical information

The researcher will now present the overall means of the biographical data combined with the nine sets of the aspects of career-readiness scores of the respondents as seen in table 4.13. For interpretation purposes, a similar way as in 4.4.11 was followed. Females found more value than males in the aspect of the use of science teaching aids with a score value of 4.31. They also found more value than males in the aspect of the use of learner-centred approach with a score mean of 4.18, the aspect of the use of questioning skills with 4.16, the aspect of broad scientific knowledge base with 4.12. While on the other hand, males found more value than females in the aspect of positive attitude towards science with 4.15. In summary, gender plays a role in perceptions of career readiness.

The findings showed that respondents from urban areas found more value than those in rural areas. This is particularly in the aspect of the use science teaching aids with a score mean value of 4.24, the aspect of positive attitude towards science with a score value of 4.17, the aspect of skills and confidence with 4.12, the aspect of the use of questioning skills with 4.08, and the aspect of the use of the processes of science with 4.05. On the other hand, respondents from the rural areas found more value than those from urban area in the aspect of a broad scientific knowledge base with a score value of 4.06.Overall, area of origin plays a role in the perceptions of career readiness.

It was discovered that respondents of age range between28-30 years found more value than those from other ages. These include the aspect of the use of teaching aids with a score mean value of 4.38, the aspect of the use of science processes with 4.15, the aspect of broad scientific base with 4.09 and the aspect of the use of science teaching methods with 4.01. Respondents from the age group between 22-24 years found more value than the other groups. This is particularly in the aspect of positive attitude towards science with a score mean value of 4.23,

the aspect of skill and confidence with 4.32, the aspect of questioning skills with 4.33 and the aspect of the use of learner-centred approach with 4.33.In summary, age does have an effect on perception with reference to the responses.

The findings showed that respondents with 0-1 year teaching experience found more value than the other experiences. This is particularly in the aspect of positive attitude towards science with a score 4.20, the aspect skills and confidence with 4.19, the aspect of the use of science processes with 4.14, the aspect of the use of questioning skills with 4.17 and the aspect of a broad scientific base with 4.15. However, respondents with more than seven years teaching experience found more value than the others in the aspect of the use of teaching aids with a score mean value of 4.44. Respondents with 6-7 years teaching found more value than others in the aspect of contribution of science to society with 4.08.

The study indicated that respondents who have 'A' level certificates found more value than the other certificate holders. This is particularly in the aspect of the use of teaching aids with a score mean of 4.73; the aspect of skills and confidence with 4.29; the aspect of science processes with 4.27; the aspect of the use of teaching methods with 4.07; the aspect of the use of learner-centred approach in teaching with 4.54; and the aspect of a broad scientific knowledge base with 4.32. On the other hand, the respondents who have certificates found more value than the others in the aspect of positive attitude towards science with a score mean of 4.19 and the aspect of the use of questioning skills with 4.18.

The study further showed that respondents who completed high school 11 years ago found more value than those who completed later. This is particularly in the aspect of positive attitude towards with a score mean of 4.25; the aspect of the use of processes science with 4.13; the aspect of the use of teaching aids with 4.62; the aspect of the use of learner-centred approach in teaching with 4.54; the aspect of the use of questioning skills with 4.29; the aspect of a broad scientific base with 4.5; and the aspect of contribution of science to society with 4.5. Conversely, respondents who completed high school 1-3 years ago found more value than the others in the aspect of skills and confidence in teaching with a score mean of 4.24.This is shown in the table 4.13 below.

Table 4.13: The overall means of the biographical data combined with the nine sets of the aspects of career readiness scores of the respondents

Gender	N Obs	Variable	N	Mean	Std Dev	Minimum	Maximum
Male	42	Attitude	42	4.15	0.54	2.33	4.83
		Confidence skills	42	4.05	0.66	2.17	5.00
		Science process	42	3.88	0.77	1.60	5.00
		Teach methods	42	3.66	0.72	2.29	4.93
		Teach aids	41	4.04	0.81	1.15	5.00
		Learner-centred	41	3.99	0.75	2.23	4.92
		Question skills	41	3.90	0.71	2.33	5.00
		Knowledge base	41	3.90	0.65	2.36	5.00
		Contribute Society	41	3.67	0.89	1.92	5.00
Female	67	Attitude	67	4.10	0.70	2.00	5.00
		Confidence skills	67	4.09	0.73	2.25	5.00
		Science process	67	4.11	0.69	2.33	5.00
		Teach methods	67	3.97	0.77	1.86	5.00
		Teach aids	67	4.31	0.69	1.00	5.00
		Learner-centred	67	4.18	0.71	1.77	5.00
		Question skills	67	4.16	0.72	2.50	5.00
		Knowledge base	67	4.12	0.75	2.00	5.00
		Contribute Society	67	3.88	0.97	1.00	5.00

Area	N Obs	Variable	N	Mean	Std Dev	Minimum	Maximum
Urban area	31	Attitude	31	4.17	0.72	2.00	5.00
		Confidence skills	31	4.12	0.71	2.25	4.92
		Science process	31	4.05	0.80	1.60	5.00
		Teach methods	31	3.94	0.74	1.86	4.92
		Teach aids	31	4.24	0.73	2.38	5.00
		Learner-centred	31	4.12	0.77	1.77	5.00
		Question skills	31	4.08	0.78	2.33	5.00
		Knowledge base	31	4.01	0.82	2.00	5.00
		Contribute Society	31	3.85	0.91	2.00	5.00
Rural area	79	Attitude	79	4.10	0.61	2.33	5.00
		Confidence skills	79	4.06	0.70	2.17	5.00
		Science process	79	4.01	0.70	1.80	5.00
		Teach methods	79	3.82	0.77	1.93	5.00
		Teach aids	78	4.20	0.75	1.00	5.00
		Learner-centred	78	4.11	0.72	1.77	5.00
		Question skills	78	4.07	0.71	2.33	5.00
		Knowledge base	78	4.06	0.67	2.36	5.00
		Contribute Society	78	3.79	0.96	1.00	5.00

Age	N Obs	Variable	N	Mean	Std Dev	Minimum	Maximum
19-21 years	2	Attitude	2	3.46	0.77	2.92	4.00
		Confidence skills	2	3.76	0.72	3.25	4.27
		Science process	2	3.47	0.28	3.27	3.67
		Teach methods	2	3.46	0.15	3.36	3.57
		Teach aids	2	3.81	0.49	3.46	4.15
		Learner-centred	2	3.38	0.53	3.00	3.75
		Question skills	2	3.54	0.29	3.33	3.75
		Knowledge base	2	3.50	0.71	3.00	4.00
		Contribute Society	2	3.33	0.71	2.83	3.83
22-24 years	17	Attitude	17	4.23	0.67	2.75	5.00
		Confidence skills	17	4.32	0.52	3.08	5.00
		Science process	17	4.08	0.67	2.86	4.93
		Teach methods	17	3.86	0.71	2.46	4.93
		Teach aids	16	4.38	0.61	2.38	5.00
		Learner-centred	16	4.33	0.44	3.00	4.85
		Question skills	16	4.33	0.50	3.09	5.00
		Knowledge base	16	4.14	0.53	3.00	5.00
		Contribute Society	16	3.60	1.11	1.00	5.00
25-27 years	62	Attitude	62	4.12	0.69	2.00	5.00
		Confidence skills	62	4.04	0.75	2.17	5.00
		Science process	62	4.02	0.79	1.60	5.00
		Teach methods	62	3.89	0.83	1.86	5.00
		Teach aids	62	4.10	0.87	1.00	5.00
		Learner-centred	62	4.02	0.85	1.77	5.00
		Question skills	62	4.07	0.78	2.33	5.00
		Knowledge base	62	4.03	0.79	2.00	5.00
		Contribute Society	62	3.86	0.97	1.00	5.00
28-30 years	21	Attitude	21	4.16	0.50	3.17	4.91
		Confidence skills	21	4.17	0.54	2.92	5.00
		Science process	21	4.15	0.57	2.80	5.00
		Teach methods	21	4.01	0.52	2.93	5.00
		Teach aids	21	4.42	0.39	3.62	5.00
		Learner-centred	21	4.29	0.48	3.46	5.00
		Question skills	21	4.05	0.69	2.50	5.00
		Knowledge base	21	4.09	0.63	2.71	5.00
		Contribute Society	21	3.86	0.77	2.58	5.00
> 30 years	8	Attitude	8	3.98	0.47	3.50	4.67
		Confidence skills	8	3.65	0.84	2.70	4.92
		Science process	8	3.76	0.76	2.73	4.93
		Teach methods	8	3.43	0.89	2.64	4.86
		Teach aids	8	4.29	0.51	3.33	5.00
		Learner-centred	8	4.14	0.59	3.46	5.00
		Question skills	8	3.76	0.79	2.92	4.92
		Knowledge base	8	3.94	0.74	3.07	4.93
		Contribute Society	8	3.82	0.90	2.67	4.92

Age	N Obs	Variable	N	Mean	Std Dev	Minimum	Maximum
Experience	**N Obs**	**Variable**	**N**	**Mean**	**Std Dev**	**Minimum**	**Maximum**
0-1 years	88	Attitude	88	4.20	0.57	2.00	5.00
		Confidence skills	88	4.19	0.60	2.42	5.00
		Science process	88	4.14	0.65	1.60	5.00
		Teach methods	88	3.93	0.72	1.86	5.00
		Teach aids	87	4.28	0.71	1.00	5.00
		Learner-centred	87	4.20	0.67	1.77	5.00
		Question skills	87	4.17	0.65	2.50	5.00
		Knowledge base	87	4.15	0.63	2.50	5.00
		Contribute Society	87	3.88	0.93	1.00	5.00
2-3 years	8	Attitude	8	3.60	0.82	2.33	4.50
		Confidence skills	8	3.41	0.79	2.17	4.67
		Science process	8	3.19	0.79	1.80	4.27
		Teach methods	8	3.26	0.92	2.29	4.92
		Teach aids	8	3.38	0.96	2.15	4.92
		Learner-centred	8	3.28	1.02	2.23	5.00
		Question skills	8	3.36	0.95	2.33	4.92
		Knowledge base	8	3.22	0.82	2.36	5.00
		Contribute Society	8	3.06	0.83	2.25	4.67
4-5 years	2	Attitude	2	3.25	0.24	3.08	3.42
		Confidence skills	2	2.79	0.18	2.67	2.92
		Science process	2	3.07	0.09	3.00	3.13
		Teach methods	2	3.07	1.10	2.29	3.85
		Teach aids	2	3.42	0.16	3.31	3.54
		Learner-centred	2	3.38	0.54	3.00	3.77
		Question skills	2	3.33	0.24	3.17	3.50
		Knowledge base	2	3.39	0.15	3.29	3.50
		Contribute Society	2	3.17	0.82	2.58	3.75
6-7 years	2	Attitude	2	3.96	1.00	3.25	4.67
		Confidence skills	2	3.79	1.12	3.00	4.58
		Science process	2	3.90	0.80	3.33	4.47
		Teach methods	2	3.79	0.81	3.21	4.36
		Teach aids	2	4.31	0.65	3.85	4.77
		Learner-centred	2	4.31	0.44	4.00	4.62
		Question skills	2	3.92	1.18	3.08	4.75
		Knowledge base	2	4.04	0.66	3.57	4.50
		Contribute Society	2	4.08	0.82	3.50	4.67

Age	N Obs	Variable	N	Mean	Std Dev	Minimum	Maximum
> 7 years	10	Attitude	10	4.09	0.83	2.08	4.73
		Confidence skills	10	3.94	0.95	2.25	4.75
		Science process	10	3.89	0.91	2.73	4.73
		Teach methods	10	3.98	0.81	2.93	4.79
		Teach aids	10	4.44	0.38	3.77	4.85
		Learner-centred	10	4.18	0.64	3.38	4.85
		Question skills	10	3.95	0.90	2.90	4.83
		Knowledge base	10	3.95	0.97	2.00	4.86
		Contribute Society	10	3.88	1.03	2.67	4.92

Certificate	N Obs	Variable	N	Mean	Std Dev	Minimum	Maximum
Matric/ Grade 12	7	Attitude	7	3.85	0.65	3.08	4.50
		Confidence skills	7	3.95	0.76	2.67	4.58
		Science process	7	3.82	0.62	3.00	4.60
		Teach methods	7	3.83	0.85	2.29	4.57
		Teach aids	7	3.98	0.84	2.38	4.62
		Learner-centred	7	3.96	0.69	3.00	4.62
		Question skills	7	3.62	0.80	2.50	4.67
		Knowledge base	7	3.90	0.68	3.00	4.71
		Contribute Society	7	3.70	0.89	2.58	4.75
A level	2	Attitude	2	4.17	0.47	3.83	4.50
		Confidence skills	2	4.29	0.41	4.00	4.58
		Science process	2	4.27	0.09	4.20	4.33
		Teach methods	2	4.07	0.30	3.86	4.29
		Teach aids	2	4.73	0.05	4.69	4.77
		Learner-centred	2	4.54	0.33	4.31	4.77
		Question skills	2	4.04	0.53	3.67	4.42
		Knowledge base	2	4.32	0.35	4.07	4.57
		Contribute Society	2	3.63	0.88	3.00	4.25
SGCSE	73	Attitude	73	4.12	0.61	2.00	5.00
		Confidence skills	73	4.07	0.72	2.17	5.00
		Science process	73	4.00	0.77	1.60	5.00
		Teach methods	73	3.82	0.79	1.86	5.00
		Teach aids	72	4.17	0.82	1.00	5.00
		Learner-centred	72	4.06	0.78	1.77	5.00
		Question skills	72	4.08	0.73	2.33	5.00
		Knowledge base	72	4.03	0.72	2.36	5.00
		Contribute Society	72	3.75	1.01	1.00	5.00
Other certificate	28	Attitude	28	4.19	0.73	2.08	5.00
		Confidence skills	28	4.10	0.68	2.25	5.00
		Science process	28	4.12	0.66	2.87	5.00
		Teach methods	28	3.94	0.70	2.93	5.00
		Teach aids	28	4.35	0.46	3.46	5.00
		Learner-centred	28	4.27	0.62	2.92	5.00
		Question skills	28	4.18	0.71	2.90	5.00
		Knowledge base	28	4.11	0.76	2.00	5.00
		Contribute Society	28	3.98	0.79	2.67	5.00

Complete	N Obs	Variable	N	Mean	Std Dev	Minimum	Maximum
1-3 years ago	19	Attitude	19	4.24	0.56	2.92	5.00
		Confidence skills	19	4.24	0.68	3.00	5.00
		Science process	19	3.93	0.74	2.80	5.00
		Teach methods	19	3.75	0.71	2.46	4.79
		Teach aids	18	3.92	1.03	1.15	5.00
		Learner-centred	18	4.01	0.79	2.46	5.00
		Question skills	18	3.95	0.75	2.33	5.00
		Knowledge base	18	3.93	0.71	2.86	5.00
		Contribute Society	18	3.81	0.88	2.25	5.00
4-7 years ago	72	Attitude	72	4.09	0.68	2.00	5.00
		Confidence skills	72	4.08	0.71	2.17	5.00
		Science process	72	4.10	0.73	1.60	5.00
		Teach methods	72	3.92	0.79	1.86	5.00
		Teach aids	72	4.25	0.72	1.00	5.00
		Learner-centred	72	4.12	0.77	1.77	5.00
		Question skills	72	4.15	0.72	2.33	5.00
		Knowledge base	72	4.12	0.71	2.00	5.00
		Contribute Society	72	3.83	0.99	1.00	5.00
8-11 years ago	17	Attitude	17	4.12	0.61	2.75	4.92
		Confidence skills	17	3.85	0.65	2.70	4.75
		Science process	17	3.81	0.71	2.73	4.67
		Teach methods	17	3.67	0.67	2.69	4.64
		Teach aids	17	4.31	0.37	3.62	4.92
		Learner-centred	17	4.12	0.54	2.92	4.69
		Question skills	17	3.83	0.73	2.92	4.83
		Knowledge base	17	3.78	0.71	2.71	4.79
		Contribute Society	17	3.62	0.83	2.58	4.83
>11 years ago	2	Attitude	2	4.25	0.47	3.92	4.58
		Confidence skills	2	4.08	0.82	3.50	4.67
		Science process	2	4.13	0.66	3.67	4.60
		Teach methods	2	3.86	1.31	2.93	4.79
		Teach aids	2	4.62	0.33	4.38	4.85
		Learner-centred	2	4.54	0.33	4.31	4.77
		Question skills	2	4.29	0.65	3.83	4.75
		Knowledge base	2	4.50	0.40	4.21	4.79
		Contribute Society	2	4.50	0.47	4.17	4.83

4.4.13 Possible biographical effects on the perceptions of career readiness

The researcher will now present the readiness trends of possible biographical effects of gender, residing area and completion period of the respondents on the perceptions of career readiness.

The Cochran–Armitage trend test was done to find out whether biographical properties affect respondent perceptions of career readiness (Shani, 2011:75). It tested readiness trend for male and female, urban and rural and completion period, whether it differs significantly for these groups of respondents. The probability of the calculated Z statistic of this analysis assumes the value of 1.25 for gender, 1.75 for area and 1.29 for completion period, which shows that readiness trends do not differ statistically significantly for the groups: males and females, urban and rural and completion period.

It was also deduced that respondents in readiness level 28-36 felt that they are not so ready to teach based on their perceptions of the course whereas those in range 37- 44 felt ready to teach based on their perceptions. This is shown in the following tables.

Table 4.14: The readiness trends of possible biographical effects of gender of the respondents on the perceptions of career readiness

Readiness levels	Gender		
Frequency Percent Row Pct Col Pct	Male	Female	Total
28-36	18 50.00	23 37.10	41 41.84
37-44	18 50.00	39 62.90	57 58.16
Total	36 36.73	62 63.27	98 100.00
Frequency Missing = 1			

Table 4.15: The readiness trends of possible biographical effects of area of origin of the respondents on the perceptions of career readiness

Readiness levels	Area(Area)		
Frequency Column percentage	Urban area	Rural area	Total
28-36	7 26.92	34 46.58	41 41.41
37-44	19 73.08	39 53.42	58 58.59
Total	26 26.26	73 73.74	99 100.00

Table 4.16: The readiness trends of possible biographical effects of completion of high school of the respondents on the perceptions of career readiness

Readiness	Completion of High school			
Frequency Column percentage	1-3 years ago	4-7 years ago	> 8 years ago	Total
28-36	6 37.50	24 37.50	11 57.89	41 41.41
37-44	10 62.50	40 62.50	8 42.11	58 58.59
Total	16 16.16	64 64.65	19 19.19	99 100.00

4.4.14 The effect of biographical properties on readiness perceptions by means of variance

The researcher will now present the effect of biographical properties on career readiness perceptions by means of variance in table 4.17.

Analysis of variance (ANOVA) was done to identify whether and which biographical properties statistically significantly influence respondents' perceptions of career readiness. For interpretation purposes, if the probability is less than 0.05 or 0.01 or 0.001 the test is regarded to be statistically significant. For this study, the results for the aspect of questioning skills (0.02) and scientific knowledge base (0.04) proved to be reliable.

These results also indicate that gender is identified as having a statistically significant effect on perceptions for both of these career readiness aspects (with 0.01 and 0.02) level of significance. On the other hand, area alone is not statistically significant but the interaction effect of gender and area is a statistically significant effect on the perceptions of questioning skills and scientific knowledge base with (0.01 and 0.02). This is indicated in the table 4.17.

Table 4.17: The effect of biographical properties on career readiness perceptions by means of variance

Construct	General F-statistic	Probability (F-statistic)	F-statistic (gender)	Prob F-statistic gender	F-statistic (area)	Prob F-statistic area	F-statistic (interact gender, area)	Prob F-statistic (gender, area
Overall readiness	1.64	0.18	4.64	0.03	0.18	0.67	1.56	0.21
Attitude	0.2	0.89	0.24	0.65	0.43	0.51	0.02	0.89
Confidence, skills	0.14	0.93	0.16	0.68	0.01	0.91	0.22	0.64
Science Process	1.29	0.28	3.81	0.05	0.33	0.56	1.28	0.26
Teaching methods	0.47	0.80	0.63	0.43	0.01	0.95	0.56	0.64
Teaching aids	1.57	0.20	4.62	0.03	0.34	0.56	1.14	0.29
Learner-centred	1.04	0.38	3.01	0.09	0.38	0.51	1.38	0.24
Questioning skills	3.30	0.02*	8.79	0.01**	1.8	0.18	6.34	0.01**
Science Knowledge base	2.93	0.04*	7.47	0.01**	2.63	0.11	6.04	0.02*
Contribute, society	1.90	0.13	4.33	0.04	0.70	0.41	4.34	0.04

ANOVA is an alternative way to investigate the possible effects of biographical properties on perceptions (Anderson, 2008:32).

4.4.15 The interaction of gender and area on reflections of questioning skills and scientific knowledge

The researcher will now present the interaction of gender & area on perceptions of questioning skills & scientific knowledge on career readiness as seen in Table 4.18

Table 4.18: The interaction of gender and area of origin on reflections of questioning skills and scientific knowledge

It was indicated that the perceptions of urban males on career readiness for the aspect of questioning skills differs statistically significant (with a mean score of 3.35 which approximate '3' indicating seldom) from males in rural areas (mean score of 4.01), and both females in urban and rural areas (with mean scores of 4.29 and 4.09). The last three means approximate '4' which indicates to perception of fairly often. Table 4.18 below indicates this.

Gender	Area	Question Skills LSMEAN	
Female	**Rural area**	4.09267089	A
Female	**Urban area**	4.29406566	A
Male	**Rural area**	4.01626560	A
Male	**Urban area**	3.35476190	B

Silverman (2006:102) states that interaction effects represent the combined effects of factors on the dependent measure. Silverman (2006:102) further states that, when an interaction effect is present, the impact of one factor depends on the level of the other factor.

The researcher argues that the Comparisons of means tests specifically the Interaction effect of gender and area of origin on perceptions of questioning skills will now be presented in Table 4.19.

Comparisons of means tests: Interaction effect of gender and area of origin on reflections of questioning skills

(Means with different small letters appended differ statistically significantly from one another).

Table 4.19: Comparisons of means tests: Interaction effect of gender and area on reflections of questioning skills

For the scientific knowledge base, it was indicated that the perceptions of urban males (with a mean score of 3.33 which approximates '3' and indicates 'seldom') differs statistically significant from males in rural areas (with mean of 4.02) and both females in urban and rural areas (with mean scores of 4.21 and 4.07). The last three means all approximate '4', which indicates 'fairly often'.

Gender	Area	Knowledge BaseLSMEAN	Comparison symbols
Female	**Rural area**	4.06949059	a
Female	**Urban area**	4.21130952	a
Male	**Rural area**	4.02264239	a
Male	**Urban area**	3.33045526	b

4.4.16 Analysis of open ended question responses

The researcher included some open-ended questions and the responses are summarised as follows.

The respondents were then asked to write comments and suggestions regarding the science education curriculum and training provided at the College. They were only 68 respondents out of 110 who answered the open-ended questions yielding a response rate of 62%. The following categories were identified from the responses namely: content, experiential learning and content delivery and will briefly be discussed as follows:

- **Content**

The respondents suggested that the curriculum includes current newsworthy situations for example, epidemic diseases like Ebola in Africa and the applications of new technology. The respondents also felt that health and environmental issues, everyday life issues and leadership in science should be added in the curriculum. Furthermore, the respondents suggested that sustainable development and Inclusive Education be intergraded in the curriculum. Some of the respondents remarked that the present

Science education curriculum is too broad and that the science education curriculum should have a narrower focus with the concurrent depth as contact teaching time is limited.

- **Content delivery**

The respondents felt that more time should be given to the teaching method *field trips* for learners to gain confidence in this teaching approach. They also indicated that lecturers should also use different teaching methods instead of lecturing all the time. Some of the respondents reported that sport in science and the local curriculum should also be taught to enrich the practicing teachers to produce good scientists. Some respondents suggested that they should learn more about issues like about global warming and the conservation of electricity in their homes.

- **Experiential learning**

Some respondents remarked that more practical sessions and experiments should be carried out in the course for better understanding of the scientific concepts and also to equip student teachers with manipulative skills. Some respondents requested the Nazarene Teachers College to construct a state of the art science laboratory that can be used for optimal experiential learning to facilitate a better understanding of scientific concepts and science process skills.

4.5 SUMMARY

In this chapter, the biographical background of the respondents has been described. These include the perceptions on the nine different career readiness concepts, findings of the internal consistency reliability in the aspects of career readiness, the overall mean score of these aspects, differences in perceptions of the aspects according to the different respondent groups, the effect of biographical properties on readiness by means of variance and the analysis of open-ended questions. Chapter5 will address the summary, findings, recommendations, limitations, and the conclusion to the study.

CHAPTER 5: SUMMARY, FINDINGS, RECOMMENDATIONS, LIMITATIONS, AND CONCLUSIONS

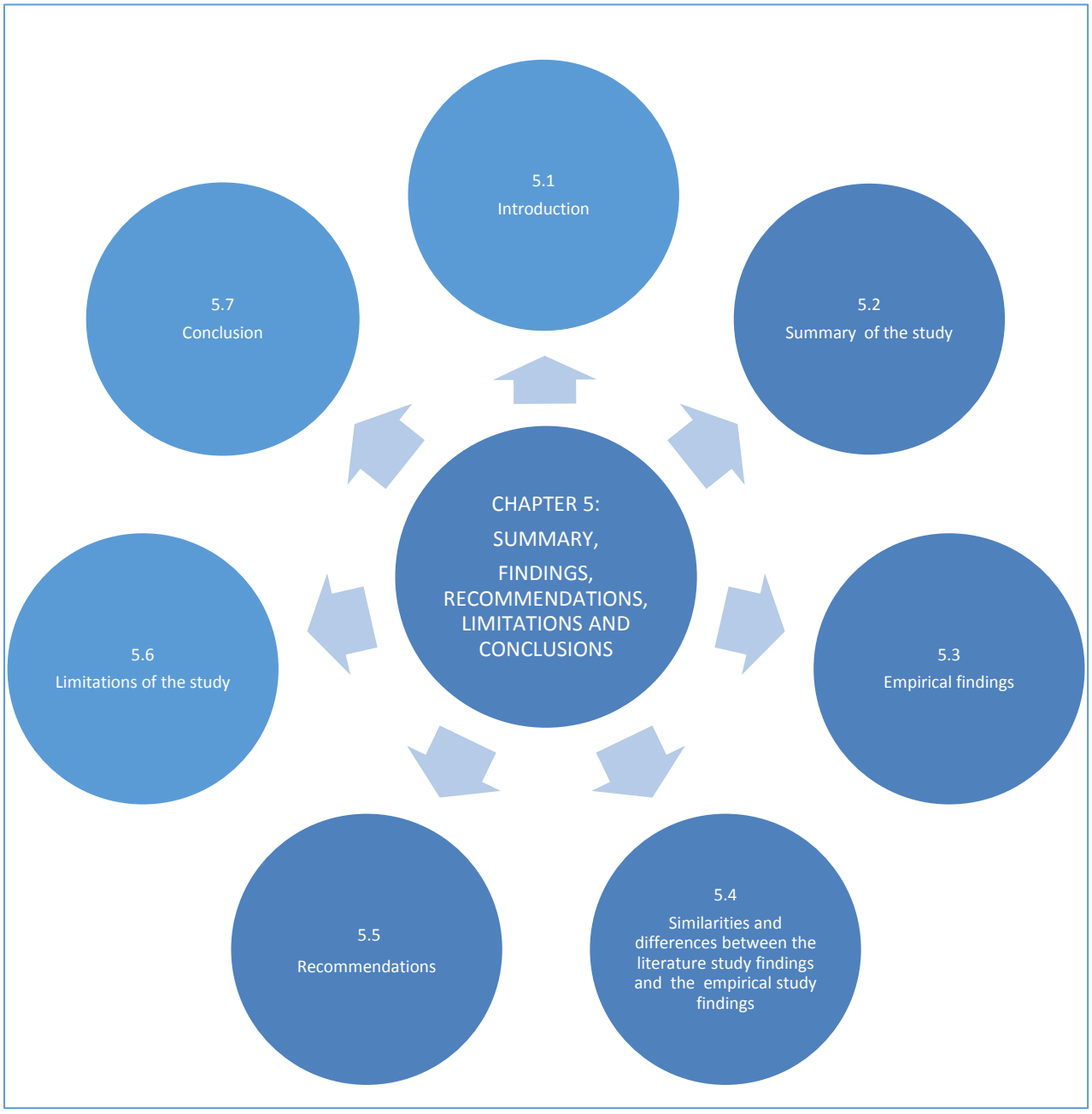


Figure 8: Visual presentation: structure of chapter 5

5.1 INTRODUCTION

In chapter 4 the findings of the study have been presented and discussed. Chapter 5 presents the summary, findings and recommendations as well as the limitations with reference to this study.

Chapter 1 highlighted the background information of the study. It also looked at the rationale of the study, the problem statement, the objectives of the study and the main and sub-research questions that served as a guide for this research. It also outlined the significance and the limitations of the study. Important key concepts used in this study were clarified and the main focus of the study was discussed. It also looked at chapter division, the theoretical framework adopted by the study, research methodology account, research approach and design, data collection method, and data analysis. It further highlighted the issues of reliability and ethics to be considered when carrying out this research.

Chapter 2 outlined the literature review. It started by giving the reader a brief picture of the Kingdom of Swaziland and Nazarene Teachers College. It then analysed literature from different sources on the science education course, curriculum evaluation and evaluation of career readiness. It also indicated the theoretical framework in which this research is anchored.

Chapter3 focused on the research methodology. The researcher studied the different research approaches, the research design, and data gathering techniques were also highlighted. It described the structure of the questionnaire, sample size and data analysis procedure. Issues of reliability and validity were also explained and then ethical considerations.

Chapter 4 discussed data analysis and interpretation of the empirical findings. A questionnaire (see Appendix A) as compiled by the researcher has been used to investigate the career readiness of respondents as teachers after completing the science education course at the Nazarene Teachers College. The research instrument starts off by describing biographical information of the respondents, followed by their responses to

the grouped questionnaire questions that probed the various career readiness concepts. It also looked at how reliable these sets of questionnaire items measure the concepts. Perception scores were deduced and the overall readiness was measured and noting effect of the biographical properties on the perceptions of the respondents.

The summary of this study will now be discussed.

5.2 SUMMARY OF THE STUDY

The following section presents a brief overview of the findings of whole study. The purpose, research questions, related literature, research methods, and procedures are summarised as follows.

5.2.1 Purpose of the research study

The growing demand for science education teachers and the shortage of skilled specialized teachers specifically in science education indicate a growing demand for teacher education programmes to prepare the students adequately to meet the present and future demand in teaching (Richie, 2009:109). Therefore, the researcher argues that student teachers are able to evaluate their own level of preparedness as they are the ones who are going through the process of learning, which is part of the curriculum. Therefore, effective curriculum evaluation for teacher education should also involve the perspectives of students, which are actually much needed, which indicate the need and purpose of this research. It is argued that the critical evaluation of at least one Science course is a necessary requirement if science education in Swaziland is to rise to the challenge as stated by the Ministry of Education and Training (2011: 44).

The main research question of this study (refer to section 1.5.2.1) can be formulated as:

- *How do the final year students evaluate their career readiness after completing the Science education course at the Nazarene Teachers College?*

The sub-questions (refer to section 1.5.2.1) that were further taken into account were:

- How do students rate their training in terms of their attitudes towards science teaching?
- How do students rate their training regarding science teaching skills?
- How do students rate their training regarding their ability to teach science processes?
- How do students rate their training in terms of their ability to use appropriate science teaching methods?
- How do students rate their training in terms of their capability to prepare science teaching aids?
- How do students rate their training regarding their competence in facilitating learner-centred pedagogy?
- How do students rate their training regarding their questioning skills and a sound knowledge base in science teaching?
- How do students rate their training regarding their awareness of the value of science for society?
- How do students rate their training regarding their career readiness according to their biographical information?
- How do students rate their training regarding career readiness taking possible biographical effects into account?

In order to achieve the study's purpose, the researcher intended to investigate the following research objectives (see, section 1.5.2):

- To gain insight into the evaluation of students regarding their career readiness after completing the science education course at Nazarene Teachers College, Kingdom of Swaziland; and
- To make recommendations for improving the science education programme based on the evaluation of students at the Nazarene Teachers College in the Kingdom of Swaziland.

An overview of the literature study will now be presented.

5.2.2 An overview of the literature findings

In reference to the literature study in Chapter 2, the following main findings indicate what the literature relates about the study:

- Science education at the primary school covers three (3) areas, namely: energy and forces; materials; and living things, which are the basics for Physics, Chemistry and Biology. It does not only embrace knowledge, but also the scientific method and its impact on learners. Science at primary schools aims at developing science process skills, obtaining scientific concepts and developing positive attitudes (Refer to section 2.3).
- Curriculum Studies in Education embraces curriculum evaluation which is a process of judging the worth or value of a curriculum. It focuses on curriculum development and teaching and this is essential in learning experiences (Refer to section 2.4).
- Curriculum evaluation determines the effectiveness of an educational programme whereas curriculum assessment determines a rate or amount of student learning. Curriculum evaluation has also been described as the method applied when determining the strengths of the activities applied in curriculum practice (Refer to section 2.4).
- Assessment was described as a term used to determine whether outcomes of instruction have been achieved or not. It included learning, teaching and outcomes. It has been reported that assessment reveals the level of understanding of course content by the students to an institution (Refer to section 2.4.2).
- Needs assessment was referred to as a method of finding out and looking at the requirements between prevailing conditions more especially those of interest. A needs assessment helps to upgrade ones' education, training and also his organization. It was reported as a very useful tool in programme evaluation. It has been remarked that needs assessment formally identifies the gaps between current results, outcomes or products and required desired or expected results.

It then prioritizes these identified gaps for action usually through the implementation of a new or existing curriculum and management process (Refer to section 2.4.2.1).

- Functions and roles of curriculum evaluation were as follows: determines the quality of a programme or course or classroom instruction as measured against the objectives set out in the beginning; it is used to describe the determination of the level of quality. Other functions are formative and summative evaluations. Other reasons highlighted for using evaluation were as follows: improvement of instruction; appraisal of the material of instruction used; an indication of pupils' growth; a basis for guidance; basis for promotion; criteria for the selection of instructional materials and appraisal of the entire curriculum improvement. Therefore, evaluation provides a reason and a means for continuous curriculum improvement. The findings from evaluation may have implications for teacher preparation and in-service programmes (Refer to section 2.4.3).
- Curriculum evaluation designs included quasi-experimental design, pre-post assessment design, and portfolio assessment design and student surveys (Refer to section 2.4.4).
- Many studies have identified key competencies and skills required for career readiness in teaching. Some of those put forward as general competencies of high quality education are: communication, problem solving, interpersonal relationships, planning and strategic thinking, visioning and evaluation (Refer to section 2.5).
- In the perspective of a pedagogy based on the competencies, the following practices were the main goal of the science teacher training: scientific processes for observations, experiments, research of information and critical analysis of this information, realization of didactical situations, management of these situations, scientific communication, and evaluation (Refer to section 2.5).

A summary of the research methodology and procedures as well as the research instrument (questionnaire) that has been used to measure curriculum effectiveness with specific reference to the science education course at the Nazarene Teachers College is discussed next.

5.2.3 Research methodology and procedures

In reference to Chapter 3 on research design and methods, an *exploratory research design* was employed in this study to investigate students' evaluation of the science curriculum. The study was quantitative in nature and "employed" quantitative data collection methods.

For this study, a survey was selected for collecting data for its suitability to the research topic. The questions were structured such that Section A included biographical information, Section B included the nine (9) science teaching empowerment objectives with open-ended questions and Section C were comments and suggestions regarding the science education curriculum and the teacher training provided at the Nazarene Teachers College. A self-administered questionnaire was selected as the most suitable method of collecting data and was disseminated by hand.

After a number of iterations, the questionnaire structure was submitted to the Unisa Statistician for critical review. Pre-testing was done with five (5) respondents drawn from the target population to limit variations in students' answers and to increase the reliability of the questionnaire. The Statistical Package for Social Sciences (SPSS) version 17 programme was used to analyse the data. Respondents' responses to the open-ended questions were categorized and coded.

The following section summarizes the findings from analysis of the data.

5.3 EMPIRICAL FINDINGS

The aim of the research was to determine how the current science education curriculum at Nazarene Teachers College contributes to students' career readiness from their own perspective. The aim was further used into the objectives which are discussed in the next section.

Empirical findings related to the first objective, that is, to describe the students' evaluation of career readiness after completing the science education course at Nazarene Teachers College are as follows:

- It was indicated that *the science education course strengthened the respondents' attitudes towards teaching science* (Refer to section 4.4.1).
- The science education course influenced the respondents' confidence and skills to teach primary school learners (Refer to section 4.4.2).
- The science education course enables respondents to use the processes of science when teaching (Refer to section 4.4.3).
- The respondents' experienced the science education course as strengthening their use of science teaching methods (Refer to section 4.4.4).
- The respondents experienced science education course as promoting their confidence to prepare science teaching aids for primary school learners (Refer to section 4.4.5).
- The science education course enables the respondents to focus on a learner-centred approach when teaching (Refer to section 4.4.6).
- From the experiences of the respondents, they reported that the science education course strengthened their questioning skills (Refer to section 4.4.7).
- The science education course provided the respondents with a broad scientific knowledge base to teach primary school learners (Refer to section 4.4.8).
- The respondents overall were however not so convinced of the contribution of Science to society (Refer to section 4.4.9).
- There was internal consistency and reliability in all the groups of the questionnaire's items with specific reference to the career readiness of the respondents (Refer to section 4.4.10).
- Taking the mean score of the nine aspects of career readiness into account, the respondents felt somewhat more convinced that they benefitted more on the readiness aspect of the use of teaching aids. This is followed in ranking by the readiness aspect on the change of attitude towards science when teaching and thirdly the readiness aspect of focusing on a learner-centred approach (Refer to section 4.4.11).

- Female respondents found more value in the science education course with specifically the aspects of the use of teaching aids; using a learner-centred approach, questioning skills and a broad scientific knowledge base. In contrast Male respondents found more value in the aspect of a positive attitude towards Science (Refer to sections 4.4.12 and 4.4.13).
- Respondents originating from urban area found more value in the aspect of the use of teaching aids, positive attitude towards science, skills and confidence, learner-centred approach, questioning skills, and processes of science (Refer to sections 4.4.12 and 4.4.13).
- Respondents from the older mature age range 28-30 years found more value in the aspect of teaching aids, science processes and broad scientific knowledge base (Refer to sections 4.4.12 and 4.4.13).
- In contrast to the aforementioned finding, the respondents from the younger age group between 22-24 years found more value in the aspect of positive attitude towards science, skills and confidence, questioning skills, and learner-centred approach (Refer to sections 4.4.12 and 4.4.13).
- Respondents with no or limited teaching experience of 0-1 years found more value in the aspect of positive attitude towards science, skills and confidence, science processes, questioning skills, and broad scientific knowledge base(Refer to sections 4.4.12 and 4.4.13).
- Respondents with more than seven years teaching experience found more value in the use of teaching aids (Refer to sections 4.4.12 and 4.4.13).
- Respondents with A level certificates found more value in the aspect of teaching aids, skills and confidence, science processes, teaching methods, learner-centred approach, and broad scientific knowledge base. Those with other certificates found more value in the aspect of positive attitude towards Science and use of questioning skills (Refer to sections 4.4.12 and 4.4.13).
- Mature respondents who completed high school 11 years ago found more value in the aspect of positive attitude, processes of science, teaching aids, learner-centred approach, questioning skills, broad scientific knowledge, and contribution of science to society(Refer to sections 4.4.12 and 4.4.13).
- The respondents' gender and the interaction of gender and area were identified as having a statistically significant effect on the reflections for the aspect of

questioning skills and scientific knowledge base (Refer to sections 4.4.13, 4.4.14.and 4.4.15).

The similarities and differences between the literature study findings and the empirical study findings will now be discussed.

5.4 SIMILARITIES AND DIFFERENCES BETWEEN THE LITERATURE STUDY FINDINGS AND THE EMPIRICAL STUDY FINDINGS

Referring to sections 1.8 and 2.6, the researcher adopted a *reflective theory* as his theoretical framework for this study because the respondents reflected back on their teaching experiences with specific reference to science education. The researcher bears the chosen theoretical in mind that he is looking through this reflective theory "lens" at the literature and the empirical parts of the study.

According to the literature study, section 2.3, science education at the primary schools aims at developing science process skills (see Figure 9 depicting measuring volume of water as an example) and positive attitudes towards science. Section 2.3 of the literature study states that for science teachers to be effective, they ought to develop a positive attitude towards science and the teaching of science. This was in line with the empirical findings of the study that the science course at the college strengthened the students' attitude towards science, section 4.4.1, as well as the use of process skills when teaching as found in section 4.4.3.

Figure 9: Photo showing measuring volume of water

The literature study also points out (see section 2.3) that, having a range of skills appropriate for science teaching makes one to be an effective teacher and that a good Science teacher explores various strategies that enhance student learning as elaborated on in section 2.5. This is in line with the findings of the empirical study that the science education course at the Nazarene Teachers College does provide knowledge and a range of skills to teach the primary school learners effectively as seen in sections 4.4.2.and 4.4.3

According to the literature study, in section 2.3, the teaching of science can be made more effective by the use of teaching aids. It indicates that for learners to enjoy their time in the classroom, the learners should be encouraged by a confident science teacher who is able to prepare and use teaching aids. Similarly, the empirical study has indicated that the respondents felt more convinced that they benefitted more on the career readiness aspect of the use of teaching aids as seen in section 4.4.5.

From the literature study in section 2.3 it could also be found that for learners to gain adequate knowledge they should actively participate in their learning. Teachers, specifically science teachers, should also nurture a healthy relationship with the learners, promote co-operation among learners and encourage active learning. Based on the empirical findings of the study, section 4.4.6, the science education course at the

Nazarene Teachers College has similarly enabled the students to focus on a learner-centred approach when teaching thus nurturing a healthy relationship and encouraging active learning.

The literature section 2.3also highlights the fact that science teachers should be empowered to illustrate practically to learners the value of science to the society. However, based on the findings of this empirical study in section 4.4.9, the respondents differed from the literature findings, as they were not so convinced that the science education course at the College is of so much importance to the society.

The similarities and differences between the literature study and the empirical study as well as the findings of the empirical study will feed into the recommendations of the study, which will now be discussed.

5.5 RECOMMENDATIONS

As mentioned in Chapter 1, the aim of this research was to describe the final year students' evaluation of career readiness after completing the teaching course in science education at Nazarene Teachers College in the Kingdom of Swaziland. The theoretical and empirical findings of this research are incorporated with the following recommendations for the re-curriculation of the science education course and recommendations for further research.

5.5.1 Recommendations for the re-curriculation of the science education Course

To make recommendations proposing the science education Course be re-curriculated following the students' experiences at the Nazarene Teachers College.

- The Nazarene Teachers College should increase time allocated to science education and its associated teaching methods for improved career readiness as expressed by respondents in section 4.4.16.

- The Nazarene Teachers College should construct a state of the art science laboratory for optimal experiential learning to facilitate a better understanding of scientific concepts and science process skills particularly for urban origin students as found in sections 4.4.12 and 4.4.13.

Figure 10: Photo showing students investigating a chemical reaction

- The Nazarene Teachers College should review the science education curriculum to make it more relevant in the career readiness of primary school science teachers in Swaziland. This is found in sections 1.2; 2.3 and 4.4.8. The science education course content should be adaptable and include current newsworthy issues such as Education for Sustainable Development, outbreaks of diseases such as the Ebola outbreak and global warming according to section 4.4.16. Some respondents in section 4.4.16 remarked that the present science education curriculum is too broad and should have a narrower focus with the concurrent depth.
- The academic staff of the Nazarene Teachers College is encouraged to increase the use of integrated methods of teaching science to facilitate more inclusive and learner-centred learning processes as seen in sections 2.5; 4.4.2 as well as section 4.4.3.
- The science education curriculum of the Nazarene Teachers College should provide more information with reference to the construction and use of

improvised laboratory materials by students to improve their career readiness as shown in section 4.4.5.

- The science education curriculum requires a serious focus to illustrate the value of science to society in particular to cater for female students who hail from rural areas as seen in section 4.4.9. Section 2.3 clearly indicates a need for more practical examples that really assist the society and this is emphasised by the respondents' statements in section 4.4.16.

5.5.2 Recommendations for further research

Recommendations for further study can revolve around the research instrument of this empirical study (see, the questionnaire in Appendix A). The questions can be improved and expanded on to add new information and other career readiness aspects to an empirical study. The research instrument focused on the input of students as respondents necessitating the input of science education lecturers, which would add another component in the evaluation of the science education programme to add more depth to the study. A comparative empirical study that would include the other two (2) teacher training colleges in Swaziland could be planned since the science education courses are similar.

5.6 LIMITATIONS OF THE STUDY

The following limitations of the study should be mentioned. The study focused only on the science education programme at the Nazarene Teachers College. The students (respondents) in the empirical study can be biased in their opinions about the curriculum even though they are adequately prepared because of their negative or positive attitude toward the science education lecturer. Some respondents may have been biased in their responses even though they were assured of anonymity. Respondents may have misunderstood rated questionnaire statements and incorrectly rated their level of career readiness.

Since time to collect data was limited with final year examinations looming only the science education curriculum was evaluated at the Nazarene Teachers College. The

other subjects' curriculum should also have been evaluated to provide a holistic evaluation of the teacher training courses.

It is limiting to consider curriculum as the only contributing factor to students' career readiness as teachers in primary schools in Swaziland. Other factors contribute to students' career readiness as teachers.

Bearing these limitations of the study in mind, the following conclusion to the study will be discussed.

5.7 CONCLUSION

In this study entitled: "Student evaluation of career readiness after completing the science education course at the Nazarene Teachers College, Kingdom of Swaziland" the findings of the literature study and the empirical study were analysed and discussed. This study analysed the effectiveness of the science education curriculum from the perspectives of students' perceptions of career readiness on completion of this course. It further identified the aspects of career readiness of students as science education teachers.

Overall, the science education course at the Nazarene Teachers College indeed prepares the final year students for their career readiness with specific reference to the teaching profession although some aspects can be improved.

In this concluding chapter, the literature findings as well as the empirical finds were discussed. Recommendations were made from these findings, which will inform the science education academic staff of the Nazarene Teachers College to reflect on and improve the curriculum with the aim to produce graduates who are career ready as teachers.

This research reveals that the science education course at the Nazarene Teachers College "strengthened" the students' attitudes positively towards teaching science, influenced their skills and confidence to teach, and enables their teaching to focus on a learner-centred approach. Students indicated that the use of specific teaching methods

and the use of teaching aids contributed in a major way to their preparation as teachers in the classroom.

Students recommended that the science education Course at the Nazarene Teachers College be re-curriculated. More contact teaching time should be allocated to science education with its associated teaching methods. Furthermore, it is advised that a state of the art science laboratory be constructed to allow for optimal experiential learning. This in turn would facilitate a better understanding of scientific concepts and science process skills, particularly for urban origin students.

The science education course contributes to the career readiness of primary school science teachers in Swaziland. The science education course content should be adaptable and include current newsworthy issues. Some respondents remarked that the present science education curriculum is too broad and should have a narrower focus with the concurrent depth. The academic staff of the Nazarene Teachers College should be encouraged to use more integrated methods of teaching science to facilitate a more inclusive and learner-centred approach to learning. The need for more information with reference to the construction and use of improvised laboratory materials by students to improve their career readiness was expressed.

The science education curriculum requires a major re-focus to illustrate the value of science to society in particular to meet the challenges for female students who hail from rural areas. This can be achieved by the use of more practical examples that really assist society to improve the quality of life.

According to the researcher the abovementioned literature findings and empirical findings and by implementing the subsequent recommendations, the final year students at the Nazarene Teachers College should be more career ready to be better equipped science educators in the Kingdom of Swaziland.

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APPENDIX A: THE QUESTIONNAIRE

Title: Student evaluation of career readiness after completing the science education course at Nazarene Teachers College Kingdom of Swaziland

Dear respondent

You are invited to participate in the following study.

The **specific purpose** of this questionnaire is to determine the effect that the Science Education curriculum has on your career readiness as a teacher.

Your input will provide valuable information on the effectiveness of the science training of teachers at the College. The results will enable the College to reflect on and improve the effectiveness of the curriculum so that College students can be better prepared for their careers as science teachers.

Completion of the questionnaire will take approximately 20 minutes.

Please consider the following:

- Participation in the study is not compulsory. You may withdraw from completion of the questionnaire at any stage.

- The answering of these questions is anonymous. The researcher requests you not to write your name on the questionnaire. Information collected is considered confidential and will be used exclusively for this research study.

- The questionnaire is divided into three (3) sections namely:

- **Section A: Biographical information**
- **Section B: Evaluating the effectiveness of the nine (9) science teaching-empowerment objectives. These encompass the content areas of the science curriculum as well as aspects of the training most useful to prepare students as science teachers.**
- **Section C: Comments and suggestions regarding the curriculum and the training provided at the College.**

- Your responses are recorded by using a five point Likert scale

Not at all 1	Very seldom 2	Seldom 3	Fairly often 4	Always 5
				

- Thank you in advance for partaking in this research.

Yours faithfully

Mr Eugene S Mhlanga

(MEd student in Natural Science Education)

College of Education

University of South Africa (UNISA)

Section A

Biographical information

For office use

Please tick the most appropriate option to each question:

1. What is your gender?

1. Male	
2. Female	

---

2. What is your age?

1. 19-21 years	
2. 22-24 years	
3. 25-27 years	
4. 28-30 years	
5. Older than 30 years	

---

3. What is your teaching practice experience in a primary school?

1. 0-1 years	
2. 2-3 years	
3. 4-5 years	
4. 6-7 years	
5. More than 7 years	

4. What did you do to finance your studies at the College?

1. Paid for my studies	
2. Used a study bursary	

5. Did you study science when you were in high school?

1. Yes	
2. No	

6. Where is your home located?

1. Urban area	
2. Rural area	

7. What school leaving certificate were you awarded?

1. Matric/Grade 12	
2. Advance level(A Level)	
3. Swaziland General Certificate in Secondary Education (SGCSE)	
4. Other certificate	

8. When did you complete high school?

1. 1-3 years back	
2. 4-7 years back	
3. 8-11 years back	
4. More than 11 years back	

Section B

The **purpose** of this section is to **evaluate the effectiveness** of the science teaching empowerment objectives of the science education curriculum of Nazarene Education College.

Evaluating the effectiveness of the nine (9) science teaching-empowerment objectives. These encompass the content areas of the science curriculum as well as aspects of the training most useful to prepare students as science teachers.

Guidelines for answering of the following questionnaire items:	

Please judge how frequently each statement corresponds with your own science teaching practice experience by using the following Five point Likert rating scale:

Not at all 1	Very seldom 2	Seldom 3	Fairly often 4	Always 5
				

Please note:

- Use an **X** to indicate your choice. See the example below.

Not at all 1	Very seldom 2	Seldom 3	Fairly often 4	Always 5
				
			X	

- Choose only <u>one option</u> per item.
- Your choice is neither wrong nor correct.
- Your honest opinion is sought.
- Please answer all the questions.

A: The training I received at the College influenced <u>my attitude</u> …	**Not at all** **1**	**Very seldom** **2**	**Seldom** **3**	**Fairly often** **4**	**Always** **5**
1. to be positive towards teaching Science.					

OFFICE USE ONLY

2. to encompass a sense of wonder and fascination for Science.							
3. to share the wonder of scientific discoveries with learners.							
4. to find science fascinating as the lecturers instilled in me a sense of wonder about scientific discoveries.							
5. to inspire learners to engage with scientific processes finding answers to questions like the following example: "What is the Chemistry behind baking powder?"							
6. to always give prompt feedback to my learners regarding questions they asked or assessments they completed.							
7. to strive to create diverse learning experiences for my learners.							
8. to be a positive 'change agent' that promotes the learning of Science.							
9. to develop a positive attitude towards Science in learners.							
10. to instil an increased interest regarding Science.							
11. to inspire learners to participate more readily in Science activities.							
12. to appreciate the value of discussing the nature of Science with learners.							

Do you have anything else you might wish to add/clarify to this section? If so, please write it down in the space below.

B: The training I received at the College influenced <u>my skills and confidence</u> to teach primary school learners as it …	**Not at all** **1**	**Very seldom** **2**	**Seldom** **3**	**Fairly often** **4**	**Always** **5**	**OFFICE USE ONLY**
1. allows me to explain basic scientific principles in a clear understandable way.						

2. allows me to understand scientific principles which in turn enables me to easily explain them.						
3. allows me to apply a learner-centred approach.						
4. allows me to be confident regarding my questioning skills, especially in formulating higher order questions.						
5. allows me to respond confidently to questions asked about the science curriculum contents.						
6. enables me to guide the learner in developing problem solving skills.						
7. allows me to confidently apply the 'Discovery-approach.						
8. enables me to apply the 'Transactional approach' as opposed to mainly a 'teacher-centred approach'.						
9. enables me to introduce different types of laboratory/science equipment in my lessons.						
10. allows me to facilitate learning experiences using investigations.						
11. empowers me to develop a foundation for facilitating the learners to understand basic science concepts. .						
12. enables me to confidently explain to my learners the world around us, such as the reasons why water evaporates and plants grow in particular locations.						

Do you have anything else you might wish to add/clarify to this section? If so, please write it down in the space below.

C. The training I received at the College has influenced me to use the <u>processes of science</u> when teaching primary school learners as it….	**Not at all** **1** 	**Very seldom** **2** 	**Seldom** **3** 	**Fairly often** **4** 	**Always** **5** 	**OFFICE USE ONLY**
1. enables me to encourage the use of basic scientific techniques such as observation and the collection of applicable data.						
2. enables me to plan practical fieldwork to observe and collect data regarding natural phenomena such as the behaviour of ants.						
3. enables me to facilitate practical fieldwork to observe and collect data regarding natural phenomena such as the behaviour of ants.						
4. empowers me to teach the skill of accurate observation such as the cycle of the seasons by observing changes in deciduous tree leaves over time.						
5. allows me to teach classification skills to learners by sorting objects into groups which introduces the concept of relationships between objects.						
6. encourages me to plan lessons so that science skills can be taught in a learner centred environment.						
7. encourages me to plan lessons so that science skills can be developed in a learner centred environment.						
8. enables me to facilitate practical activities that in turn develop science process skills.						
9. enables me to facilitate the interpretation of data as one of the complex skills that need to be developed.						
10. Gives me confidence to teach higher order/ integrated skills such as formulating a research question						

11. allows me to teach the skill of recording results effectively.						
12. allows me to teach the skill of communicating findings effectively.						
13. empowers me to understand that process skills combine to define the process of scientific investigation.						
14. allows me to appreciate the value of developing learners' process skills.						
15. enables me to view science as both a process and as a body of knowledge.						

Do you have anything else you might wish to add/clarify to this section? If so please write it down in the space below.

D. The training I received at the College influenced my <u>science teaching methods</u> to primary school learners as it…	**Not at all** **1** 	**Very seldom** **2** 	**Seldom** **3** 	**Fairly often** **4** 	**Always** **5** 	**OFFICE USE ONLY**
1.allows me to convey scientific principles by means of demonstrations.						

2.allows me to convey scientific principles by means of fieldwork.						
3.gives me confidence to teach science using a ‘project method approach’.						
4. enables me to be to be familiar with using the ‘circus approach’.						
5. enables me to have confidence using the ‘discovery approach’.						
6. allows me to plan the fieldwork method to any class size.						
7.allows me to apply the fieldwork method to any class size.						
8. empowers me to limit the use of the lecture/ transmission/ ‘chalk and talk’ approach as it is teacher-centred.						
9. allows me to utilize local learning experiences and resources that catalyses learning.						
10.empowers me to manage large classes because I can use a variety of teaching styles interchangeably.						
11. allows me to facilitate concept learning through ‘tools’, such as concept mapping.						
12. enables me to encourage active learning by using collaborative and co-operative learning.						
13. allows me to diagnose misconceptions of certain scientific concepts.						
14. enables me to understand the role of prior conceptions in the learning of science concepts.						

Do you have anything else you might wish to add/clarify to this section? If so, please write it down in the space below.

E. The training I received at the College boosted my confidence to <u>prepare science teaching aids/resources for primary school learners and use them safely</u> as it…	**Not at all 1** 	**Very seldom 2** 	**Seldom 3** 	**Fairly often 4** 	**Always 5** 	**OFFICE USE ONLY**
1. empowers me to teach scientific principles and concepts by making use of improvised teaching aids.						
2. allows me to find teaching aids such as a magnet from a discarded speaker to illustrate the concept of magnetism.						
3. empowers me to provide interactive learning opportunities such as learners taking turns standing on a bathroom scale and recording the readings as an introduction to teaching the concept of mass.						
4. empowers me with skills to make improvised scientific equipment by transforming available objects, such as mineral water bottles into beakers.						
5. encourages creativity in sourcing improvised apparatus, such as making use of soft drinks bottle tops as watch glasses.						
6.gives me confidence to prepare experiments safely.						
7.gives me confidence to conduct experiments safely.						
8. enables me to keep safety in mind at all times and especially when using chemicals or heat.						
9.instils in me the correct procedures for using expensive or improvised laboratory						

apparatus appropriately. (Example: How to heat metals safely).						
10. allows me to construct teaching aids that will engender exciting and interesting learning opportunities.						
11. makes me aware of learners' different learning styles.						
12. allows me to use teaching materials that learners are familiar with as they are locally sourced from their immediate environment.						
13. enables me to consider the characteristics of my learners when selecting teaching aids.						

Do you have anything else you might wish to add/clarify to this section? If so, please write it down in the space below.

F. The training I received at the College influenced my teaching <u>to focus on a learner-centred approach</u> as it…	**Not at all** **1**	**Very seldom** **2**	**Seldom** **3**	**Fairly often** **4**	**Always** **5**	**OFFICE USE ONLY**
1. allows me to exploit the inquisitive nature of learners.						
2. empowers me with the relevant classroom management skills during demonstrations and practicals even when a class is large.						
3. makes me value learner involvement in the teaching and learning process.						
4. emphasises the need for a harmonious relationship with learners to create an inviting educational climate in the classroom.						
5. empowers me to create experiences for collaborative learning.						
6.enables me to actively engage the learner within the teaching learning experience.						

7.allows me to consider learners ideas, preferences, learning styles and interests into account.						
8. empowers me to closely monitor learners' activities in the co-operative and collaborative approaches to minimize off-task behaviour.						
9. allows me to ask appropriate follow up questions when a learner gives an incorrect answer.						
10. allows me to pay attention to the learners' non-verbal communication (body language).						
11. makes me understand that learners construct their own meaning as they interact with educational experiences.						
12. empowers me to recognize learners as individuals, for example, calling learners by name.						
13. empowers me to recognize learners as individuals, for example, making a positive comment during practical activities.						

Do you have anything else you might wish to add/clarify to this section? If so, please write it down in the space below.

G. The training I received at the College influenced my <u>questioning skills</u> as it…	**Not at all** **1** 	**Very seldom** **2** 	**Seldom** **3** 	**Fairly often** **4** 	**Always** **5** 	**OFFICE USE ONLY**
1. enables me to stimulate learners to ask and answer the 'why' questions about scientific phenomena (For example: 'why will an insect in a closed glass jar die'?						
2. instils in me the desire to be curious and ask questions about scientific processes and phenomena.						
3. empowers me to draw generalizations from data collected.						
4. enables me to make use of targeted questions to assess learners in terms of listening, thinking and learning skills.						
5. empowers me to prepare a range of questions from low to high order by using Bloom's taxonomy.						
6. enables me to minimize questions with one-word answers.						
7. provides me with skills to motivate learners to ask relevant questions.						
8. helps me to develop inquiring and problem-solving minds.						
9. enables me to elicit ideas from learners and to guide them in formulating investigative problem statements, plans and then derive conclusions.						
10. allows me to provide possible explanations for observations in nature.						
11. makes me aware that to engage learners using a question and answer technique provides further learning opportunities.						

12. empowers me to formulate questions relating to data collected and recorded by learners.						

Do you have anything else you might wish to add/clarify to this section? If so, please write it down in the space below.

Do you have anything else you might wish to add/clarify to this section? If so please write it down in the space below.

I. The training I received at the College has made me aware of <u>the contribution of science to society</u> as it…	**Not at all** **1** 	**Very seldom** **2** 	**Seldom** **3** 	**Fairly often** **4** 	**Always** **5** 	**OFFICE USE ONLY**
1. enables me to identify naturally occurring scientific processes that benefit society. An example is the sterilizing effect of boiling water.						
2. allows me to engage with learners on how fascinating scientific principles are when they are applied to everyday life.						
3. is easy to use electronic media to illustrate how science impacts on our lives.						
4. enables me to inspire learners to understand how chemistry benefits the food industry.						
5. empowers me to practically illustrate to learners the value of science in everyday						

life. (For example: make a sand filter to show how dirty water can be treated).						
6. allows me to work with the learners in the community to address social and environmental problems such as poverty, which can, for example be alleviated by creating food gardens in the community and climate change.						
7. equips me with ways of inspiring learners to integrate learning and living by making use of scientific knowledge and problem solving skills coupled with action.						
8. enables me to inspire learners to care for the environment by using scientific knowledge. (For example: planting trees encourages soil conservation and provides many uses for humans).						
9. enables me to explain the role of science in combating disease epidemics like Ebola.						
10. enables me to compare and contrast traditional and modern scientific practices to my learners. (For example: male circumcision).						
11. empowers me to encourage the search for new scientific breakthroughs to tackle environmental issues such as pollution and alternative sources of energy such as wind and solar energy.						
12. makes me aware that science is used to engage with complex environmental issues such as global warming.						

Do you have anything else you might wish to add/clarify to this section? If so please write it down in the space below.

Section C: Comments and suggestions regarding the curriculum and the training provided at the College.

Please feel free to add anything you wish about the curriculum and the training provided at the College.

Thank you very much for your time answering this questionnaire.

APPENDIX B: THE LETTER TO THE RESPONDENTS

Letter to the respondents

Dear respondent

You are invited to participate in the following study.

The **specific purpose** for this questionnaire is to determine the effect that the science education curriculum has on your career readiness as a teacher.

Your input will provide valuable information on the effectiveness of the science training of teachers at the College. The results will enable the College to reflect on and improve the effectiveness of the curriculum so that College students can be better prepared for their careers as science teachers.

Completion of the questionnaire will take approximately 20 minutes.

APPENDIX C: THE LETTER TO THE PRINCIPAL OF THE COLLEGE

P. O. Box 602

Manzini

Swaziland.

The Principal

Nazarene Teachers College

P.O. Box 602

MANZINI

Dear Principal

My name is Eugene S. Mhlanga. I am presently studying towards a Master of Education (MEd) degree in Natural Science at the University of South Africa. My study focuses on the students' evaluation of career readiness after completing the science education course at Nazarene Teachers College Kingdom of Swaziland.

I am requesting for permission to conduct a research study on the topic of my dissertation shown in the above paragraph. I intend to protect the anonymity and the confidentiality of your college as well of that of all respondents. Although the participation of your college in this research project is very important to me, it is voluntary .Should your college wish to withdraw at any stage, or withdraw any unprocessed data supplied during the course of the study, will be free to do so.

If you agree that your college may partake, please indicate that you have read and understood this information letter by signing the accompanying permission form and return it to me.

Should you require any further information, do not hesitate to contact me.

Mr Eugene S. Mhlanga

ll +26876327483

APPENDIX D: PRINCIPAL'S PERMISSION TO CONDUCT RESEARCH AT THE COLLEGE

UNISA university of south africa

APPENDIX D
PRINCIPAL'S PERMISSION TO CONDUCT RESEARCH AT THE COLLEGE

The students evaluation of career readiness after completing the science education course at Nazarene Teachers College Kingdom of Swaziland.

Researcher: Mr Eugene S. Mhlanga
Supervisor:

I. SIBONGILE B. B. LUKHELE agree that the college can participate in the project named above. The details of the research purpose have been explained to me. An information letter has been given to me to keep.

I consent to the following: (Tick to indicate your selection)

Participation of college:
Yes ✓ No

The possible future use of the findings to inform government:
Yes ✓ No

Principal signature — Date: 20/11/2015

Researcher — Date

NAZARENE TEACHERS P.O.Box 602 Manzini 20-11-2015 Tel:505 2817 Fax: 505 6292 TRAINING COLLEGE

APPENDIX E: RESEARCH ETHICS CLEARANCE CERTIFICATE UNISA

UNISA | college of education

Research Ethics Clearance Certificate

This is to certify that the application for ethical clearance submitted by

ES Mhlanga [36475688]

for a MEd study entitled

Student evaluation of career readiness after completing the Science Education course at Nazarene Teachers' College Kingdom of Swaziland

has met the ethical requirements as specified by the University of South Africa College of Education Research Ethics Committee. This certificate is valid for two years from the date of issue.

Prof VI McKay
Acting Executive Dean: CEDU

UNISA
COLLEGE OF EDUCATION
2014 -11- 21
Office of the Deputy Executive Dean

Dr M Claassens
CEDU REC (Chairperson)
mcdtc@netactive.co.za

Reference number: 2014 NOVEMBER /36475688/MC

17 NOVEMBER 2014

APPENDIX F: CONSENT FORM FOR RESPONDENT STUDENT

UNISA university of south africa

APPENDIX F
CONSENT FORM FOR PARTICIPANT STUDENT

Student evaluation of career readiness after completing the science education course at Nazarene Teachers College Kingdom of Swaziland

Researcher: Mr Eugene S. Mhlanga

Supervisor:

I .....agree to participate in the project named above. The details of the research purpose have been explained to me. An information letter has been given to me to keep.

I give consent to the following: (Tick to indicate your selection)
My participation:
Yes No

The possible future use of the findings to inform government:
Yes No

....
Student's signature Date

....
Researcher Date

APPENDIX G: LANGUAGE EDITING CERTIFICATE

EDITING AND PROOFREADING CERTIFICATE

7542 Galangal Street

Lotus Gardens

Pretoria

0008

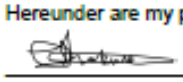
27 February 2017

TO WHOM IT MAY CONCERN

This letter serves to confirm that I have edited and proofread Mr E.S. Mhlanga's dissertation entitled: **"Student evaluation of career readiness after completing the science education course at Nazarene Teachers' College, Kingdom of Swaziland"**.

I found the work easy and enjoyable to read. Much of my editing basically dealt with obstructionist technical aspects of language which could have otherwise compromised smooth reading as well as the sense of the information being conveyed. I hope that the work will be found to be of an acceptable standard. I am a member of Professional Editors Guild.

Hereunder are my particulars:



Jack Chokwe (Mr)

Contact numbers: 072 214 5489

jmb@executivemail.co.za

Professional EDITORS Guild

Open Rubric